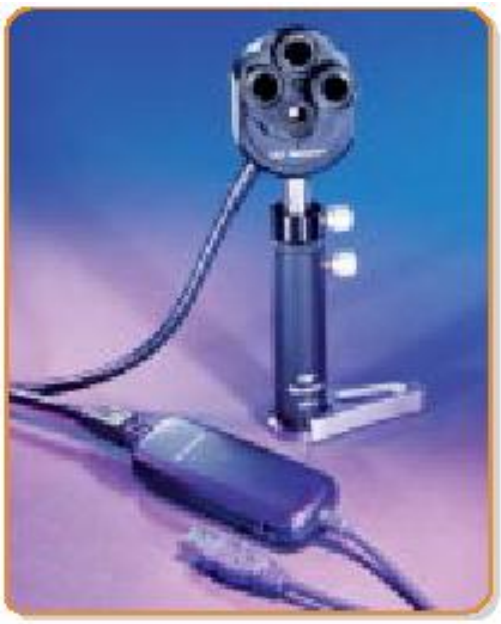
LBP Series

Laser Beam Profiler for Windows



User's Manual

Newport

EU Declaration of Conformity

This is to certify that the accompanying product, identified with the CE mark, complies with requirements of the Electromagnetic Compatibility Directives.

Model name: LBP Series

Year CE mark affixed: 2003

Type of equipment: An optical beam intensity CCD profiler intended to be installed in a Host Computer. The device is constructed from a sensor head with an attached cable, interface to the computer (PCI card or USB 2.0 Attachment) and control software.

Has been tested and was found to comply with the requirements of:

- EN 55022 : “Limits and methods of radio interference characteristics of information technology equipment; Generic emission standard”, Part 1.

  Residential, Commercial and Light Industry.

- EN 50082 : “Electromagnetic Compatibility (EMC); generic immunity standard”,

  Part 1: “Residential, commercial and light industry”.

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First printing 2003

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Newport Corporation

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Irvine, CA 92606

USA

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Newport Corporation Calling Procedure

If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a **Return Material Authorization Number (RMA#)**. Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA# and we will repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA#.

E-mail: rma.service@newport.com

When calling Newport Corporation, please provide the customer care representative with the following information:

- Your Contact Information
- Serial number or original order number
- Description of problem (i.e., hardware or software)

To help our Technical Support Representative diagnose your problem, please note the following conditions:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

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1.0 Introduction

This manual describes briefly the main capabilities of the LBP Series Beam Profiler.

The LBP Series Beam Profiler (referred to as LBP) is a beam diagnostics measurement system for real-time measurement of continuous or pulsed laser beams. It provides an extensive range of graphical presentations and analysis capabilities of laser beam parameters, such as: beam width, shape, position, power, and intensity profiles.

The LBP is offered in two main variations: One is based on a PCI board, software driven device, which resides in a user-provided host computer. The other is based on a USB 2.0 attachment, software driven device, which can be connected to a Notebook (or Desktop) computer via the High Speed USB 2.0 port.

Both versions are user-friendly systems that present graphical and numerical information for intuitive interpretation of data in real-time.

Some applications for the LBP system, include:

- Laser beam optimization
- Quality control
- Gaussian fit analysis
- Beam alignment

Main Software Features

The LBP system software features include:

- Customer set pass/fail criteria
- Zooming
- Average
- User set threshold levels
- Data logging to a text file (up to 99 hours)
- Shutter and gain software controllable
- Trigger level software controllable for pulsed lasers
- Video with playback for future analysis
- Tile images in matrix format
- Multiple PCI boards operation
- Setup for different camera types (for PCI version)
- Printing of text and pictures
- Full on line Help routine

2.0 Overview

A basic LBP system includes the following items:

A CCD detector head:

*** LBP-1 (UV)**, a camera head for the 190-1100 nm wavelength range.

* **LBP-2 (VIS)**, a camera head for the 350-1100 nm wavelength range.

*** LBP-3 (IR-1310)**, a camera head for 350-1310 nm wavelength range.

*** LBP-4 (IR-1550)**, a camera head for 350-1310 nm as well as for 1550 nm (+/-50nm).

A PC interface:
A selection of either a 1/3 size PCI card, or a USB 2.0 attachment.
The PC interface is used for connecting the CCD detector head to the computer.
For the USB 2.0 attachment there is a supplement power supply, providing the camera with 12V, 1A (for CCD camera revision "A" through "C"). A new revision "D" is provided without a supplement power supply.

Models description

The models list comprise of a combination of the CCD detector head type and the PC interface, as follows:

- **LBP-1-PCI** : UV Laser Beam Profiler, 190-1100nm, PCI interface
- **LBP-1-USB**: UV Laser Beam Profiler, 190-1100nm, USB 2.0 interface
- **LBP-2-PCI**: Visible Laser Beam Profiler, 350-1100nm, PCI interface
- **LBP-2-USB**: Visible Laser Beam Profiler, 350-1100nm, USB 2.0 interface
- **LBP-3-PCI**: IR Laser Beam Profiler, 350-1310nm, PCI interface
- **LBP-3-USB**: IR Laser Beam Profiler, 350-1310nm, USB 2.0 interface
- **LBP-4-PCI**: IR Laser Beam Profiler, 350-1310nm and 1550nm, PCI interface
- **LBP-4-USB**: IR Laser Beam Profiler, 350-1310nm and 1550nm, USB 2.0 interface

Windows Software
The installation and application software comes on a CD disk. OS supported are Windows 2000/XP and Windows Vista for USB 2.0 Attachment.

User Manual
The user manual contains the same information as the On-line Help in the software. A README.TXT in the installation disk may have corrections to the manual and the on-line help. The user manual is saved as a PDF file on the software CD.

Filter Wheel and Filters
The system is supplied with a filter wheel with room for 4 screwed on filters. The system is supplied with three NG neutral density stackable filters in housings (NG10, NG9 and NG4). The filters cover the VIS range, transmission curves enclosed in

Appendix.

Mounting Post
The post is 105 mm long with 8-32 thread and is used for mounting the detector head.

QC test and calibration certificate.

2.1 Revision History

Any new editions of this manual will incorporate all material updated since the previous edition. Update packages issued between editions contain replacement and/or additional pages to be appended to the current edition. A “ReadMe.TXT” file is provided during the installation and may contain additions or corrections to the manual or the help file.

The manual printing date indicates its current edition. Updates and corrections to the current edition will be indicated.

- Dec 2003 – Revision 1.0
- Oct 2004 – Revision 1.1
- Dec 2004 – Revision 1.2
- July 2005 – Revision 2.0
- July 2006 – Revision 2.1
- April 2007 – Revision 3.0
- Sep 2009 – Revision 3.1

2.2 Precautions

The LBP system is a precision instrument and in normal usage will provide years of trouble free operation. However, several precautions must be taken to ensure proper function of the devices.

- The instrument must not be subjected to physical abuse. If either the PCI card, USB 2.0 attachment or detector head are dropped they might be damaged.
- The system must be protected from static electrical discharge. The PCI card must be kept in its anti-static bag whenever it is not installed in a computer chassis, and should never be installed or removed without first turning the computer off.
- Temperature and moisture extremes can also damage the instruments. Make sure there is adequate ventilation for the host computer.
- Make sure you have a backup copy for the system CD disk, and that the software CD is protected from long term, direct exposure to sunlight and heat.
- When not in use, keep the Detector head and filter wheel inside the carrying case to prevent dust from accumulating on the sensor and the filters.

- Filters are provided with each LBP head. Dust, scratches and other types of contamination will degrade the accuracy of the system. Please keep unused filters in a storage case. Please be gentle when handling these fragile items.
- Laser Safety Rules: Please comply with all relevant laser safety procedures and precautions when using this device. The instrument will reflect a portion of the laser light. The resulting diffuse and specular reflections may be dangerous.

2.3 Cleaning Instructions for LBP-1 and LBP-4 units

The LBP-1 and LBP-4 units do not have a protective window on the CCD array in order to transmit the UV and also longer NIR wavelengths. As a consequence of absence of a window, the cleaning procedure of these units needs to be carried out with care and only per the recommendations from the manufacturer.

1. Use only low pressure, regulated, clean compressed air or Nitrogen (clean room quality) to blow the dust off the CCD array.

2. Be aware and avoid any contact with the bind wires that make the electrical connection to the CCD array

3. Do not use any other physical contact (lens paper or swabs) or cleaning solutions to clean the CCD array.

4. Try to keep the unit in a dust free environment as much as possible, or if need to use in a lab where there is no control on dust of other contaminating particles, then remove the filter wheel, and screw in the filters directly onto the face of the unit for added protection.

Contact Newport Corporation if you have any additional questions.

3.0 Theory of Operation

The main technologies available for laser beam diagnostics are:

- Using spatial cameras as the beam characterization system.
- Using moving mechanical slit, or knife-edges to scan across the incoming beam.

The main advantage of the mechanical scanning devices over a camera type laser beam profiler is the large dynamic range that allows accurate measurements of beams with both high and low intensities. On the other hand, camera type laser beam profilers are excellent for fast and detailed analysis of laser beam intensity profiles, but are limited in their accuracy due to a relatively low dynamic range.

The LBP Solution

The LBP overcomes the limited dynamic range of a camera type beam profiler and accurately measures faint laser beam structures by sampling the beam several times. Each measurement is performed at a different attenuation or electronic shutter speed.

The LBP analyzes both continuous wave (CW) and pulsed lasers, and accepts a wide range of input powers.

The video beam images are digitized with an 8-bit resolution (256 digital levels) video capture card. The digitized beam images are then stored in memory where a variety of analysis can be performed on the stored images. The images are then displayed on the VGA monitor according to the user-selected format.

Additional functions provide the ability to print information, transmit data via an RS-232 link to another computer, and control numerous video and calibration functions including shutter speed and camera gain.

Technology

The LBP uses a video camera and a PC card (or USB 2.0 attachment) to image, capture, store, and perform two-dimensional intensity distribution analysis on laser beams.

CCD camera laser beam profilers are based on a mosaic of two-dimensional detectors called pixels. The two-dimensional mosaic-like detector instantly records the amount of energy impending on its surface, thus recording the optical pattern of the laser beam. The intensity distribution of the laser beam is recorded pixel-by-pixel and displayed as a two-dimensional topographic map or a three-dimensional isometric view.

The advantages of a CCD based laser beam profiler is fully utilized by powerful software that displays any structure larger than one pixel in vivid colors, calculates the beam distribution and profile as well as total beam intensity distribution, in order to allow full analysis of the laser beam's characteristics.

Dynamic Range Limitation

One of the main obstacles encountered when working with a CCD camera based system is its limited dynamic range. This limits the range of power levels that can be measured, as well as the ability to view features that are smaller than 1% of the laser beam's maximum power density.

The LBP overcomes the dynamic range limitations of CCD cameras with software control of the CCD electronic shutter, as well as by using a set of calibrated optical filters to attenuate powerful beams. The proprietary shutter activation allows examination of the laser beam within a fraction of a percent from the peak intensity.

The laser beam's profiles are analyzed by using multiple images. Each one is attenuated by a different known factor, which is included in the calculation. The software then reproduces the original non-saturated picture. Faint pixels, which originally were not detectable, are now visible.

.

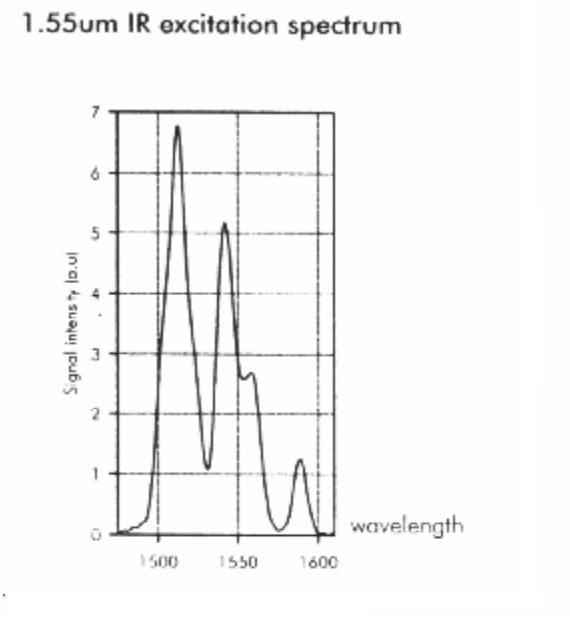
4.0 Specifications

This section describes the technical and system performance specifications.

Item	Specification
Camera and PC board	
Operation mode:	Interline camera mode for CW operation and frame transfer mode for pulsed operation.
Camera type	Monochrome interline transfer CCD ½" format
Sensor active area:	6.47mm wide x 4.83mm high.
Pixel size	8.6 µm (H) X 8.3 µm (V)
Dimensions:	ϕ64mm dia x 44.5mm deep with filters installed.
CCD focal position	Optical distance from camera front surface to sensor surface is 6.1mm ±0.2mm
Spectral Response:	LBP1 – UV & VIS range 190 - 1100nm
	LBP2 – VIS range 350 – 1100nm
	LBP3 – VIS & IR1310 version: 350 – 1310nm
	LBP4 – VIS & IR1550 version: 350 – 1310nm & 1550nm (*)
	(*) Model LBP4 is based on the standard CCD for VIS and IR1310 range, which is coated with a conversion coating, enabling capture of signals at the 1550nm +/- 50nm. See response curve below.
Weight:	340 gr. with cable, filter wheel and 3 filters
Power consumption:	12V, 0.9 Watts
Accessories included:	1 X Filter wheel, 1 plastic cap
	3 X NG 1.6mm thick Schott colored filters in housing (NG4, NG9, NG10)- Included, stackable
	8/32 threaded mounting hole
Connections to PC card:	2.5 meter cable to 8 pin mini DIN type
Sync out for triggering laser:	Optional by special order
PC interface:	1/3 size PCI P&P card, or USB 2.0 attachment
RS232:	Data out
Operating temperature:	-10ºc to 50ºc
Minimum host system requirements	Pentium 200, 64MB RAM (Pentium IV, 1GHz with 128MB RAM for USB 2.0 version)
	10MB HD free
	2MB 16bit color VGA card (16MB 16bit for USB 2.0 version)
	One free 1/3 size PCI slot (or one free High Speed USB 2.0 port)
	One CD ROM any type
	Windows 2000/XP, Windows Vista for USB 2.0 version

System Performance with Software:

Dynamic Range:	Up to 10^{11} using software controlled gain control, electronic shutter and external filters.
Shutter speeds:	1/50s to 1/100,000 sec, 9 steps manually, or automatic.
Software controlled gain	6dB to 60dB manually, or automatic.
Maximum frame rate	25Hz
Sensitivity:	~5nW/cm² at 633nm (models LBP1, LBP2)
	~15µW/mm² at 1310nm (model LBP3)
	~50µW/mm² at 1550nm (models LBP4)
Saturation intensity:	~1mW/cm² / 1µJ/cm² with no filters installed (models LBP1, LBP2).
	~5mW/cm² no filters (model LBP4)
Damage threshold	50W/cm²/1J/cm² with all filters installed.
Null:	In CW mode, null function is available to automatically subtract background.
Handling of pulses	Ability to capture and replay pictures and statistics from a slowly pulsing laser (1-100Hz) while filtering out frames with no laser pulse. Gain control and external filters make it easy to obtain optimum intensity.
Trigger:	In pulsed mode, sliding bar control allows setting of threshold so as to display only frames with captured pulses.
Max frequency for single pulse display:	10KHz



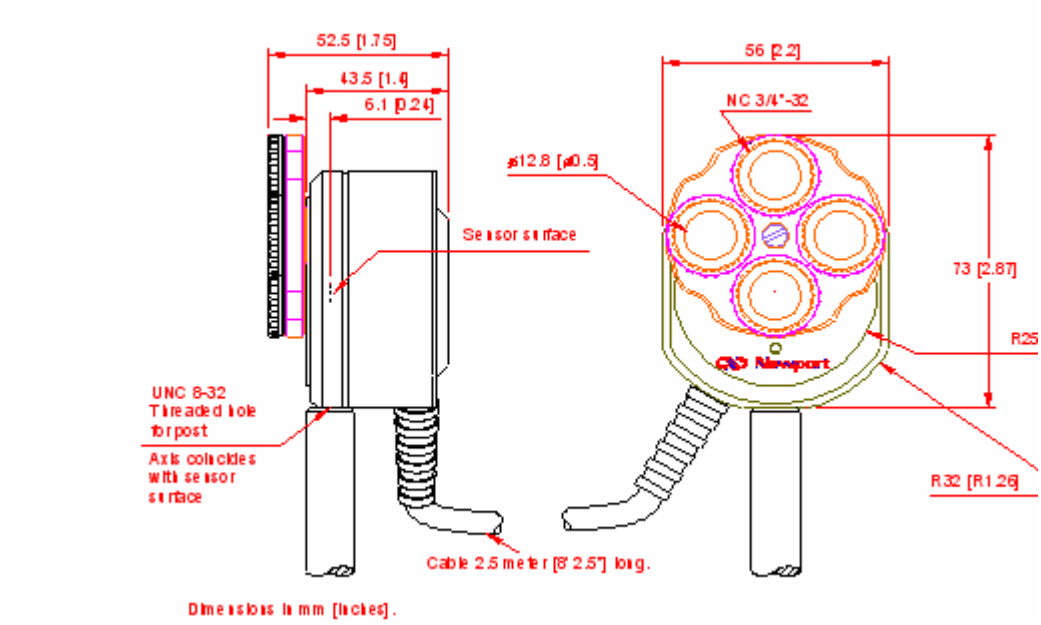


Figure 1 Camera Dimensions

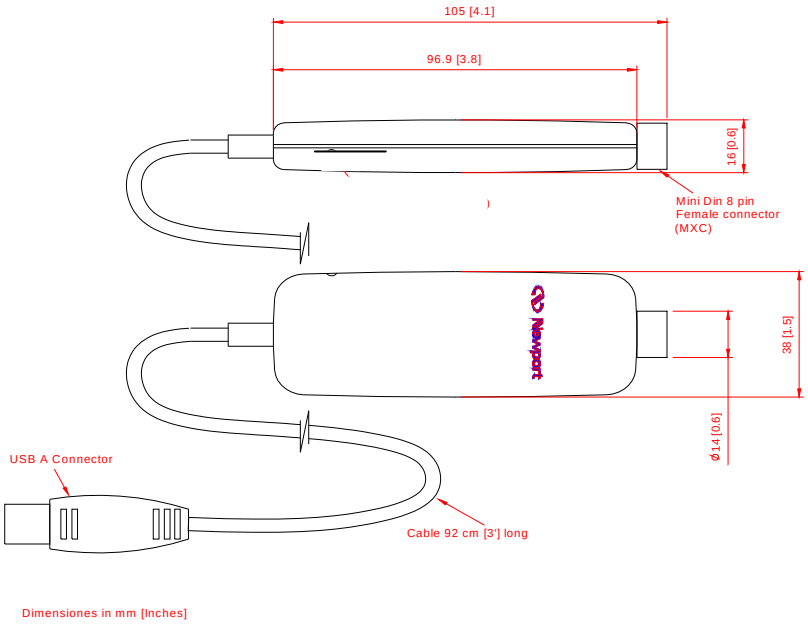


Figure 2 USB 2.0 Attachment Dimensions

5.0 Quick Reference

This chapter provides brief instructions for operating your LBP. Full explanations of these various operations can be found throughout this manual.

To install the LBP – PCI version:

1. Check **Hardware Requirements – PCI version** (chapter 6.1.1)
2. Follow **Hardware installation - PCI Board** (chapter 6.2)
3. Follow **Connecting the CCD camera to the PCI card** (chapter 6.3).
4. Perform **Software Drivers Installation – PCI card version**, (chapter 6.4)
5. Perform **Software Installation – PCI card** (chapter 6.5).

To install the LBP – USB 2.0 version:

1. Check **Hardware Requirements – USB 2.0 version** (chapter 6.1.2)
2. Follow **Software installation – USB 2.0 Attachment** (chapter 6.6)
3. Connect the CCD camera to the USB 2.0 Attachment via the 8-pin mini din connector.
4. Connect the power supply cable to the USB 2.0 Attachment via the 12V jack and plug the power supply into the surge-protector outlet. For revision "D" and above there is no supplement power supply.
5. Plug the USB 2.0 Attachment into a Hi-Speed USB 2.0 -compliant port.
6. Follow **Hardware installation – USB 2.0 Attachment** (chapter 6.6.1).

To configure the LBP hardware and software:

1. Open the Settings menu and select **Hardware Setup**.
2. Click each tab and enter your hardware information in each window.
3. Repeat steps 1 and 2 for **Software Setup**.

To set up a continuous laser beam:

1. Click on the  icon at the **Status Bar** if in pulsed mode so as to get into continuous mode 
2. Select a shutter speed that enables an acceptable saturation level.
3. If the image is still saturated at the fastest shutter speed, attach ND filters to the CCD camera until an acceptable saturation level is reached.

To set up a pulsed laser beam:

1 Click on the  icon at the **Status Bar** if in continuous mode so as to get into pulsed mode 

2 Select the slowest shutter speed (1/50s).

3 Attach ND filters to the CCD camera until an acceptable saturation level is reached.

4 Further adjust the intensity level using the gain control 

5 Adjust the trigger level using the  icon until you get a steady reading. It is best to move to the right until triggering stops, and then move back a little.

To measure the beam width:

1. Open the Settings menu and select **System Setup**.
2. Select the **Profiles** tab.
3. Set the three clip levels values.
4. Read the beam width values from the **Statistics** window.
5. To view more detailed statistics, click  to open the statistics window.

To select the profile type:

On the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles.

To view the centroid and/or beam peak:

1. Click  on the **Control Toolbar** for a 2D display.
2. Click  on the **Control Toolbar** to view the centroid.
3. Click  on the **Control Toolbar** to view the beam peak.

To freeze the screen graphics:

Click  on the **Control Toolbar**.

To return to real-time measurement mode, click  on the **Control Toolbar**.

To print various screens:

1. To print the entire screen, open the File menu and select **Print Screen.**
2. To print the view area only, open the File menu and select **Print Frame**.

To save screen graphics:

1. Open the Options menu and select **Save image File**. A sub-menu displays.
2. Select the screen section to be saved: **Frame**, **Profiles**, **Statistics** or **Full Screen**. The **Save image File** window displays. Select either a BMP or JPG file type.
3. Enter a filename for the saved screen graphic and click **OK**.

To save X-Y profiles:

1. Open the Options menu and select **Save data in text file**. A sub-menu displays.
2. Select **profiles.**
3. Enter a filename for the saved file and click **Save**.

To view and print a file:

1. Click  on the **Control Toolbar**. The **View File** window displays.
2. In the **Files of Type** field, select the file type for the file you want to view.
3. Select the file and click **OK**.
4. Click on print if you want to print the file.

To test a laser beam:

1. Click  on the **Control** Toolbar. The **Analysis Toolbar** displays.
2. To run the test, click  on the **Analysis Toolbar**. The **Test** window displays the test results.
3. To save the current test result in a bitmap or test file, click **Save** in the Test window.

To calculate a beam elliptical footprint:

1. From the **Control Toolbar**, click  to freeze the screen.
2. From the **Control Toolbar**, click  . The **Analysis Toolbar** displays.
3. From the **Analysis Toolbar**, click  . The LBP calculates the best-fit ellipse and displays it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are displayed below the Analysis Toolbar.

To measure the distance between two points on the beam image:

1. From the **Control Toolbar**, click  to freeze the screen.
2. From the **Control Toolbar**, click  . The **Analysis Toolbar** displays.
3. From the **Analysis Toolbar**, click  .
4. Select the first point by placing the cursor on the beam image and click the left mouse button. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar.

To create a data log:

1. From the **Control Toolbar**, click  to setup the data log. The **Log Setup** window displays.
2. Enter the information in the Log Setup window and click **OK**.
3. From the **Control Toolbar**, click  to start the data log function.
4. To view the data log file, open the File menu and select **View File**. Select the data log file you want to view and click **Open**.

To create a video:

1. Open the Settings menu and select **Video Properties…**. The **Video Properties** window displays.
2. Enter your information and click **OK**.
3. Click  on the **Control Toolbar**.

To play a video file:

1. Click  on the **Control Toolbar**. The **Playback Toolbar** displays.
2. Click  on the **Playback Toolbar**. The **Open Video File** dialog displays.
3. From the Open Video File dialog, select the video file you want to view and click **Open**. The video file displays.
4. Use the **Playback Toolbar** buttons to play the video.
5. Click  to close the video file.

To work with still images:

1. To capture a still image, click  on the **Control Toolbar**.
2. To view a single still image, position the cursor on the still image icon on the **Status Bar** and click the left mouse button.
3. To close an opened still image click the close button in the upper right corner of the image window. If you want to save the still image, click **Yes** in the Still Image window.

To measure two beam's centroids simultaneously:

1. From the **Control Toolbar**, click 

to select the first Region of Interest.
2. Move the small rectangle marking 

to the first beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).

3. From the **Control Toolbar**, click  to select the second Region of Interest.

4. Move the small rectangle marking  to the second beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).

To work with snapshot files:

1. To create a snapshot file, open the **Options menu** and select **Save Snapshot**. The **Save Snapshot File** window displays. Enter a filename for the snapshot file and click **OK**.
2. To view a snapshot file, open the View menu and select **Snapshot**. The **Load Snapshot File** window displays. Select a snapshot file and click **OK**. The snapshot file displays. Analyze the measured results by activating the system tools.
3. To close a Snapshot file, open the View menu and select **Snapshot**. The LBP restores real-time measurement displays.

To transmit serial data over an RS-232 link:

1. Open the File menu and select **Link Setup**.
2. Click the **General** tab and enter your information.
3. Select the **Port Settings** tab, enter your information and click **OK**.
4. Connect the LBP computer to another computer using a null-modem cable.
5. Enable the receiving program to receive the file/data.
6. Open the File menu and select **Start Link**. If you are transmitting data, the LBP automatically starts sending the data. A link-in-progress message displays in the menu bar.
7. If you are transmitting a file, the **Link File** window displays. Select the file you want to send and click **OK**. A link-in-progress message displays in the menu bar.

5.1 Software General Layout

This section covers the basic layout of the LBP software.

The LBP window display consists of display and control elements similar to most Windows applications along with elements specific to LBP interface.

5.1.1 Title Bar

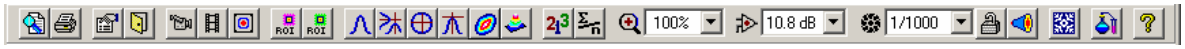
The title bar displays the name “Newport LBP Series PCI” or “Newport LBP Series USB2” and followed by the CCD detector SN.

5.1.2 Menu Bar

The Menu Bar lists menus available for LBP system. The menus contain commands and other sub-menus or dialog boxes to be displayed which provide controls of various functions: graphics, analysis, setup configurations. All functions can be activated via the menus, some functions can also be activated via the Tool Bar.

5.1.3 Control ToolBar

The Tool Bar consists of various icon buttons, which are small symbols that provide quick access alternatives to using menus or keyboard equivalent keys to perform various functions. To activate a tool button, place the mouse over the button and click the Left mouse button. The button will change both color and shadow to designate the fact that this function is activated. This is an example of ToolBar (buttons activated):



This is an example of ToolBar (buttons are disabled):

To view the function of each icon button, place the mouse cursor on the icon and wait momentarily, a brief function description will appear near the icon.

5.1.4 View Area

The View Area is used to view all the LBP graphical presentations, such as: beam image, intensity profiles, 2D/3D presentation, as well as summary table of measurement results and statistics table.

5.1.5 Status Bar

The status bar is located at the bottom of the LBP window. It indicates the current status of some operational parameters, such as presentation of date and time, image size in use, Average level, Null status, CW or pulsed laser mode, Reducer and up to 12 Still images taken.

6.0 Installation

This chapter provides instructions for installing the hardware and software for the LBP system. Two installation procedures are described: one for the PCI version and the other for the USB 2.0 attachment version.

6.1 Hardware Requirements

6.1.1 PCI Version

To run the LBP-PCI version, the computer system must meet the following minimum requirements:

Item	Minimum Requirements	Recommended Requirements
CPU	Pentium III 800MHz	Pentium 4
System RAM	128MB RAM	256MB RAM
Hard disk	100MB HD free	
CD ROM drive	Any type	
Operating system	Windows 2000/XP	
Mouse	Microsoft mouse or equivalent	
VGA display	800 x 600 resolution	1024 x 768 resolution
VGA card	2MB 256 color	8MB, 16 bit
Card socket	One free 1/3 PCI slot	

6.1.2 USB 2.0 Attachment

To run the LBP-USB 2.0 version, the computer system must meet the following minimum requirements:

Item	Minimum Requirements	Recommended Requirements
CPU	Pentium 4, 1 GHz	Pentium 4, 1.7 GHz
System RAM	128MB RAM	256MB RAM
Hard disk	100MB HD free	
CD ROM drive	Any type	
Operating system	Windows 2000/XP/Vista	
Mouse	Microsoft mouse or equivalent	
VGA display	1024 x 768 resolution	
VGA card	16MB 16 bit color	64MB 16 bit color
USB Port	One free High Speed USB 2.0	

6.2 Hardware Installation – PCI card

The video capture card is a plug-and-play card used by the LBP to capture and digitize the laser beam's images from the camera.

WARNING: *The PCI capture card is static-sensitive and should be handled with care to avoid exposure to static voltages. Electrostatic discharge can cause damage to your computer. At a minimum, touch a piece of grounded metal (such as your computer chassis) to discharge any static electricity before starting the installation.*

To install the PCI capture card:

1. Turn off your computer.
2. Remove the cover of the computer so you have access to the slots.
3. Remove the card from the anti-static bag.
4. Holding the PCI capture card at the edges, insert it into an empty PCI slot.
5. Firmly press the pins into the connector until the video capture card is seated evenly.
6. Secure the video capture card in place by tightening the screw. (See your computer's manual for information on installing expansion boards in your particular system.)
7. Replace the computer cover.
8. Continue to **Connecting the CCD camera to the PCI card.**

6.3 Connecting the CCD camera to the PCI card

After completing the PCI card hardware installation, connect a CCD camera to the PCI card and proceed with the software installation.

The following video inputs are available:

- Special Multimedia Extension Connector (MXC) - This is the input for the standard LBP camera only.
- S-Video In (Separate Y/C) - Connect a video source that uses a 4-pin mini DIN cable to this jack. Select S-Video on the Hardware Setup.
- Composite Video In - Connect a video source that uses RCA phono cable to this RCA phono jack. Select Composite on the Hardware Setup.

To connect the CCD camera provided with the LBP, connect the CCD camera cable to the 8-pin mini-DIN connector of the PCI card. Refer to the figure below.

To connect a camera other than the CCD camera provided, connect your camera cable to either the S-Video or the Composite Video connectors located on the board bracket. Refer to the figure below.

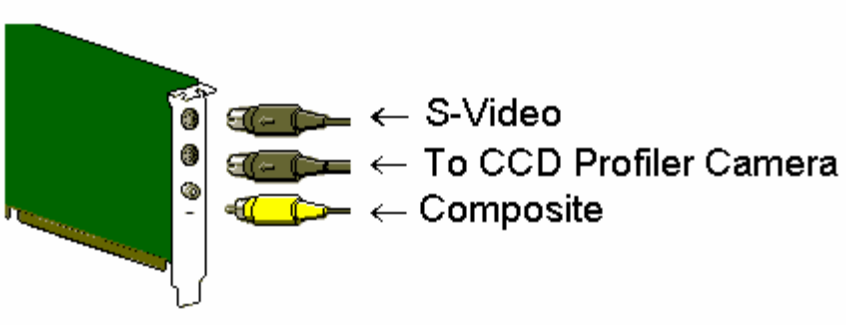


Figure 3 Connecting the LBP Camera to PCI card

6.4 Software Drivers Installation – PCI card version

Insert the LBP board into a free slot in your computer. Restart the computer. When the system prompts you with a **New Hardware Found** dialog box, press Cancel.

Figure 4 New Hardware Found Wizard.

Proceed to **Software installation – PCI card**.

6.5 Software Installation – PCI card

Insert the LBP CD disk in the CD drive.

For software installation **Select Install LBP Series PCI** button.

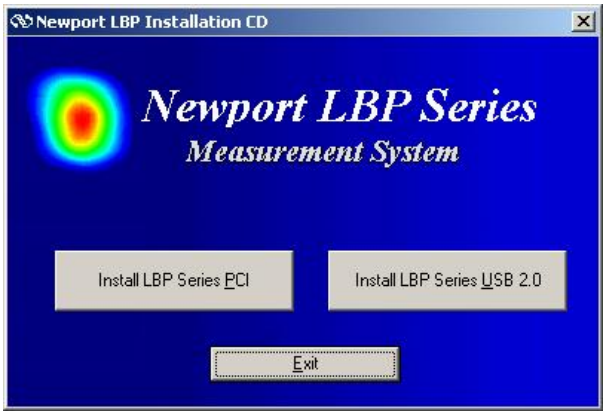


Figure 5 Welcome Screen

A Welcome screen appears when beginning the software installation routine. Click *Next*.

1. At this stage the software License Agreement is displayed. Read the agreement carefully and click *Yes* in order to proceed. If you click *No* the program is aborted.
2. Insert your User Name, Company Name and System S/N (appearing on the system CD).
3. The following screen is a Registration Confirmation. Click *Yes* in order to confirm. If you click *No*, the software will return back to a previous prompt.
4. Now provide the full path for installation of the LBP system software:
5. More information about the exact folder for the software and branching in existing folder for LBP system software can be done in the Select Program Folder prompt.
   Click the *Next* button to proceed.
6. Copying files routine. Click Next button. At this stage the system copies all files from the CD-ROM to the selected directory in your computer. There is a graphical presentation showing the amount of data copied to the system disk. If the Cancel button is pressed the installation is aborted.
7. Setup complete. At this stage, the user is requested to Restart the computer (Reset). Select *Yes* to Restart. The reason for the Restart operation is: during the installation process, there were a few drivers added to the Windows Registry, these drivers are required for the system proper operation. The drivers are activated only after the computer is rebooted.
   If you select *No* at this point, you will have to perform the Restart operation manually later on.

After completion of LBP board device installation, when the device is configured successfully one can check in System Properties, Device Manager Tab and confirm that: "Sound, video and game controllers" sub-directory now contains the "DO-PCI 1000 Adapter".

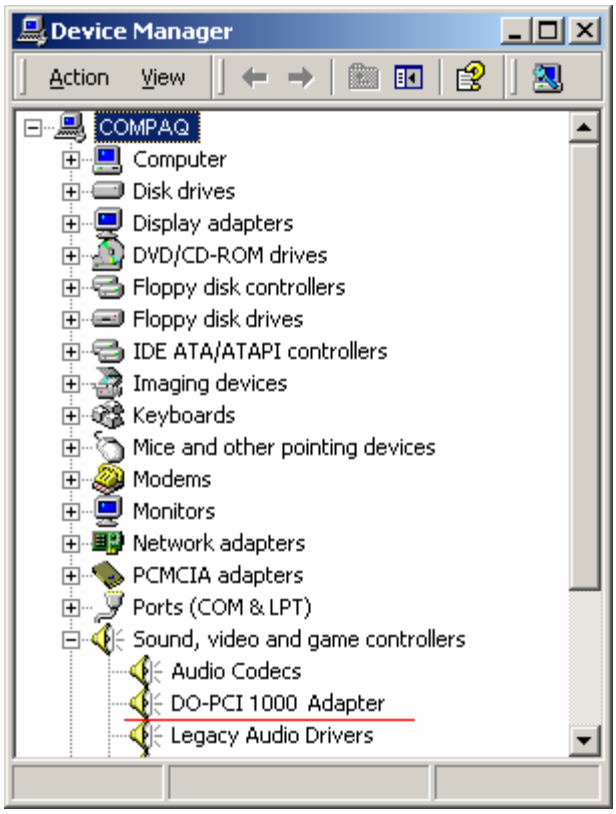


Figure 6 Drivers installed list (PCI card)

Should you face any problem with the card installation in your computer – please refer to the section: **Troubleshooting** for more information.

6.6 Software Installation - USB 2.0 Attachment

Important Note: ***Please install the USB 2.0 device driver before connecting the USB 2.0 Attachment to your computer!***

Perform **Software Installation**. Only after you click “Finish” to complete the software installation procedure, continue with the **Hardware Installation.**

1. Insert the LBP CD disk in the CD drive.

For software installation **Select Install LBP Series USB 2.0** button.

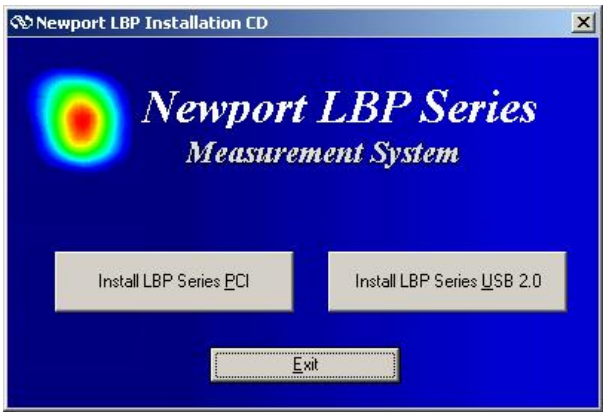


Figure 7 Welcome Screen

1. A Welcome screen appears when beginning the software installation routine. Click *Next*.
2. Insert your User Name, Company Name and System S/N (appearing on the system CD).
3. The following screen is a Registration Confirmation. Click *Yes* in order to confirm. If you click No, the software will return back to a previous prompt (stage 6 above).
   Now provide the full path for installation of the LBP USB 2.0 system software:
   More information about the exact folder for the software and branching in existing folder for LBP USB 2.0 system software can be done in the Select Program Folder prompt.
   Click the *Next* button to proceed.
4. Copying files routine. Click Next button. At this stage the system copies all files from the CD-ROM to the selected directory in your computer. There is a graphical presentation showing the amount of data copied to the system disk. If the Cancel button is pressed the installation is aborted.

5. For Windows Vista:

Figure 8 Windows Vista Security

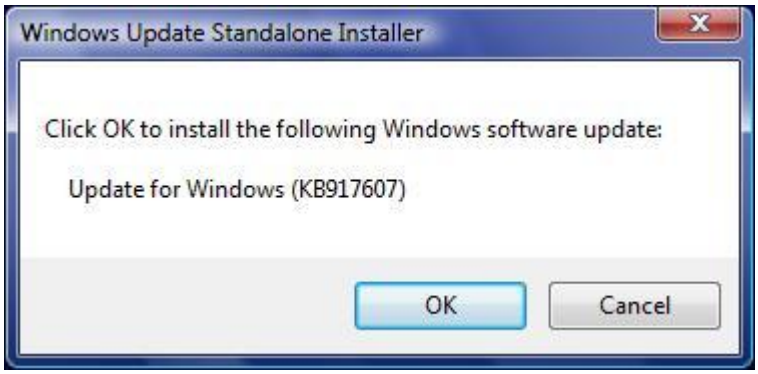


Figure 9 Windows Update

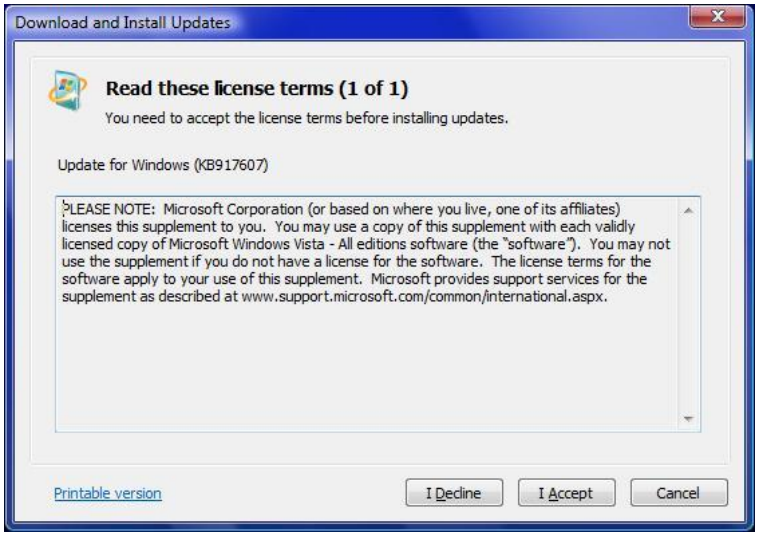


Figure 10 Download and Install Updates

Press “I Accept” button for install update.

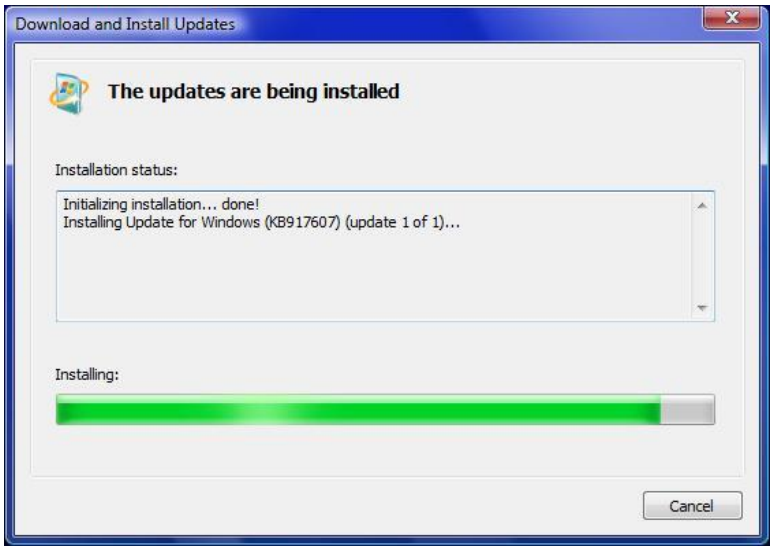


Figure 11 Update installation status

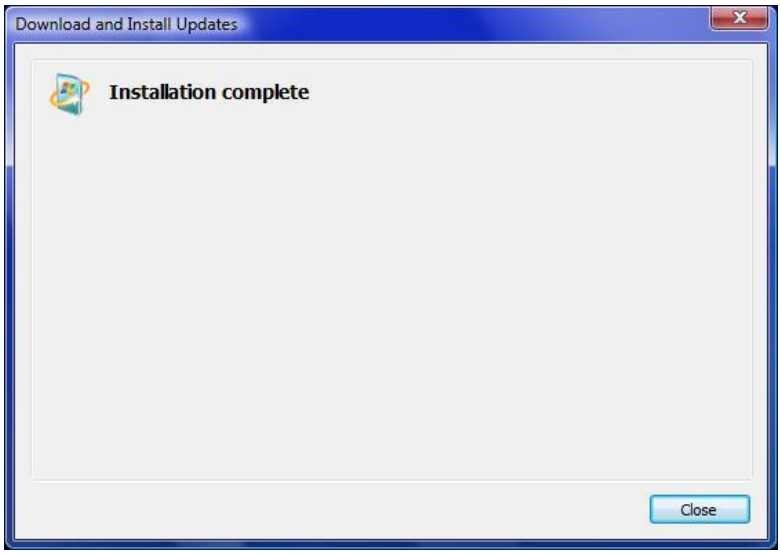


Figure 12 Installation complete

6. Setup Complete.

6.7 Hardware Installation – USB 2.0 Attachment

Plug the LBP USB 2.0 Attachment into a Hi-Speed USB 2.0 port.

The USB 2.0 device will be detected and the New Hardware Wizard will launch.

6.7.1 Windows 2000

1. The following message is displayed:

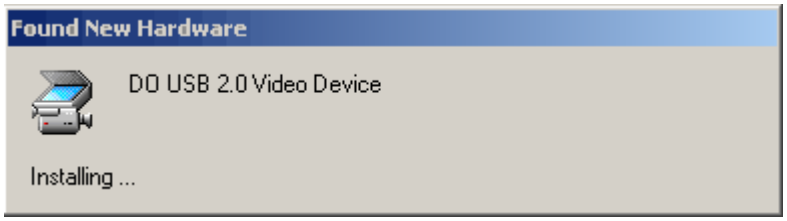


Figure 13 Found new hardware message

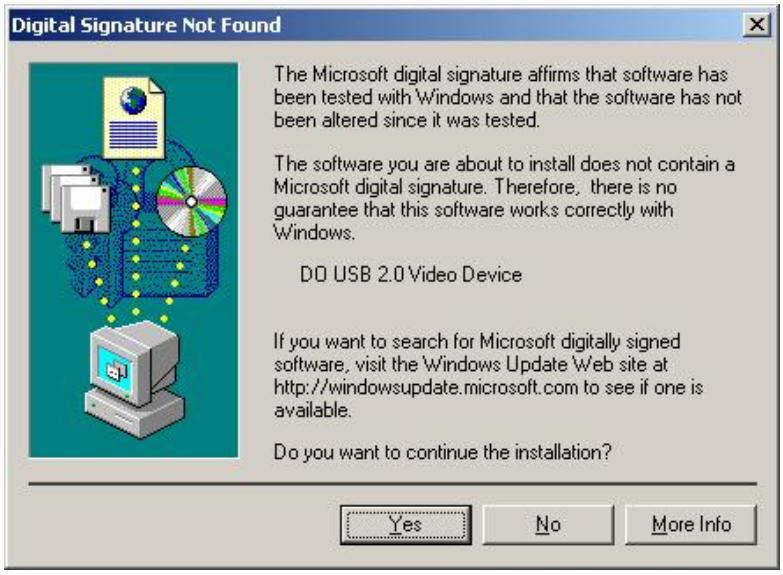


Figure 14 Digital Signature Message.

Press "*Yes*" to continue.

6.7.2 Windows XP

1. The following message is displayed

Figure 15 Found new hardware wizard

Figure 16 Welcome Screen. Press *Next* to continue.

Figure 17 Alert, press *Continue* Anyway.

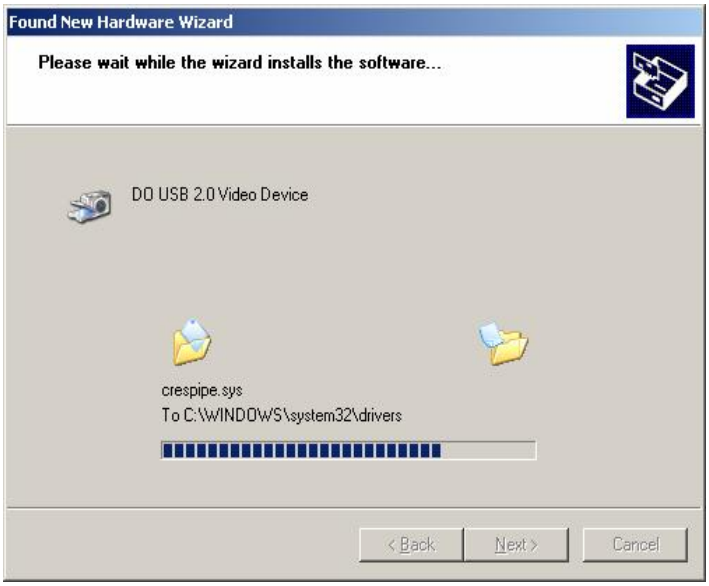


Figure 18 Installing…

Figure 19 Complete installation screen

Press *Finish* now and continue with the video device installation.

Figure 20 Found New Hardware

Figure 21 New Hardware ready to use

After completion of USB device installation, when the device is configured successfully one can check under System Properties, Device Manager Tab and see that under imaging devices the “DO USB 2.0 Video Device” is listed.

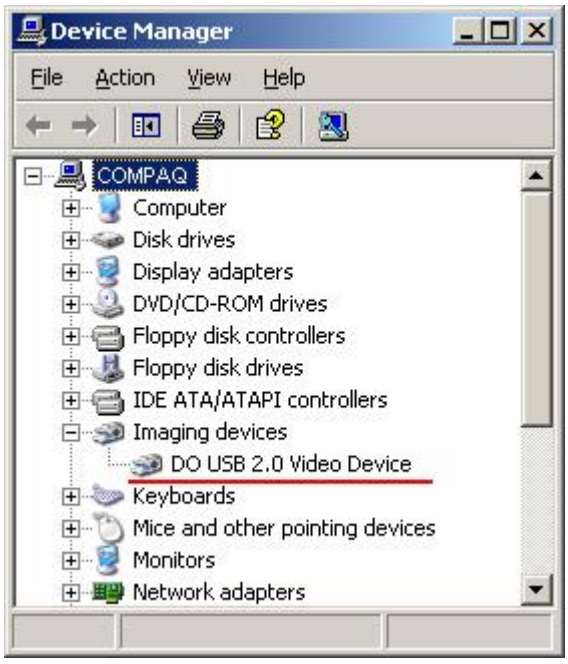


Figure 22 Drivers installed list (USB 2.0 Attachment)

6.7.3 Windows Vista

The following message is displayed

Figure 23 Installing device driver software

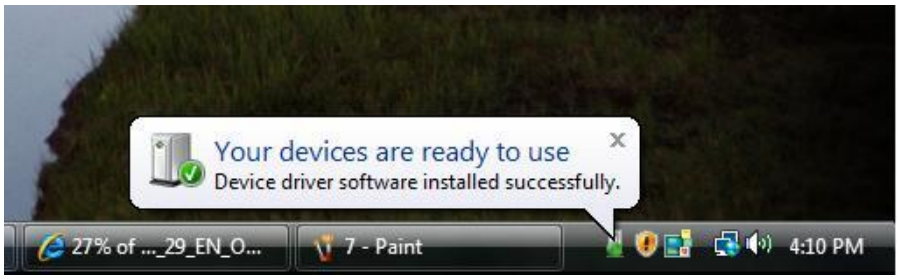


Figure 24 Devices are ready to use

After completion of USB device installation, when the device is configured successfully one can check under System Properties, Device Manager Tab and see that under imaging devices the “DO USB 2.0 Video Device+” is listed.

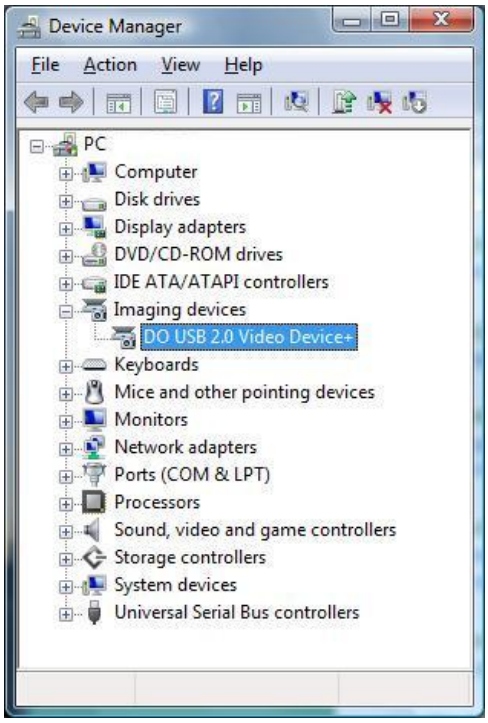
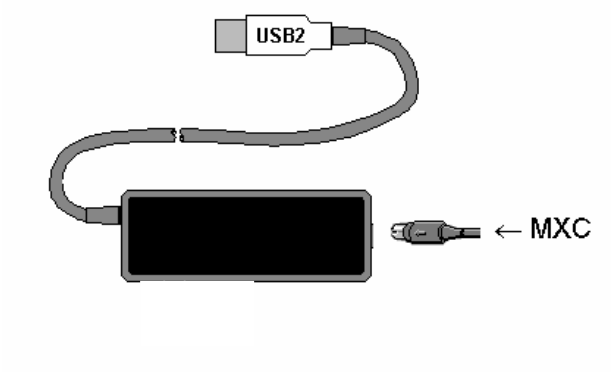


Figure 25 Drivers installed list (USB 2.0 Attachment)

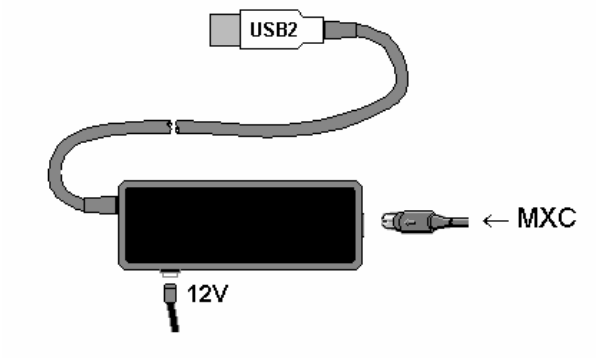
2. Connect the CCD camera to the USB 2.0 Attachment via the 8-pin mini din connector.
   2.1 Make sure that the 8pin mini din connector of the CCD camera is inserted into the 8 pin mini din connector of the USB 2.0 Attachment according to the connector key. The key match is indicated by two white mark dots on the connectors.
   2.2 Make sure that the 8pin mini din connector is firmly inserted into the matching mini din connector.
3. Connect the power supply cable to the USB 2.0 Attachment via the 12V jack and plug the power supply into the surge-protector outlet. For revision "D" and above there is no supplement power supply.

CCD camera connection diagram:
The connector is a special **Multimedia Extension Connector (MXC)**. This is the input for the standard LBP camera.

Refer to the following figure:



Revision "D"



Revisions "A" – "C"

Figure 26 Connection schematics USB 2.0 Attachment

Important Note: ***Please do not connect / disconnect CCD camera from USB 2.0 Attachment, while application program is running!***

6.8 Running the Software

Make sure hardware is installed properly. (See **Hardware Installation – PCI card**, and **Hardware Installation – USB 2.0 Attachment**). Boot the computer.

From the **Start** Menu, select **Programs**, then choose **LBP** folder, and then click on the **LBP** program. Alternatively, you can activate the software by placing the mouse cursor at the **LBP Icon** and click the mouse button twice.

To end a LBP session, open the **File** menu and select **Exit.**

The LBP saves all current setup parameters when you exit a session.

Possible Errors that indicate an interface board conflict:

There are a few common symptoms, which point to an interface board conflict:

* System Lock-up during software startup.

* There is no picture displayed on the screen

* Displayed measurements are sporadic and erroneous.

If your symptoms match one of those presented above, or if the LBP System was working at one time and has now stopped working, check for conflicts with other plug in cards in the same computer.

If it has no affect and no new software of any kind has been installed since the LBP System last worked and the computer has not been moved, contact Newport Inc. for immediate support.

More information about Installation problems in the **Troubleshooting** section.

7.0 Setting Up the LBP

This chapter provides instructions for setting up the LBP. Before you can accurately use the LBP you must do the following:

- Configure the hardware
- Configure the software
- Configure your continuous or pulsed laser beam

The LBP installs a configuration file called “Newport LBP Series.ini” in the LBP working directory. All system setup parameters are saved in this file, including all setup modifications introduced during the last session. When you start the system software, the setup parameters in the INI file are automatically loaded.

7.1 Configuring the Hardware

To configure the hardware, open the Settings menu and select **Hardware Setup**. The Hardware Setup window displays.

7.1.1 Hardware Setup - Settings

From the Settings tab, you can configure the following information:

- Type of connected camera equipment (Default PAL camera via MXC connector)
- Input connector
- Image display
- Shutter control
- Gain control

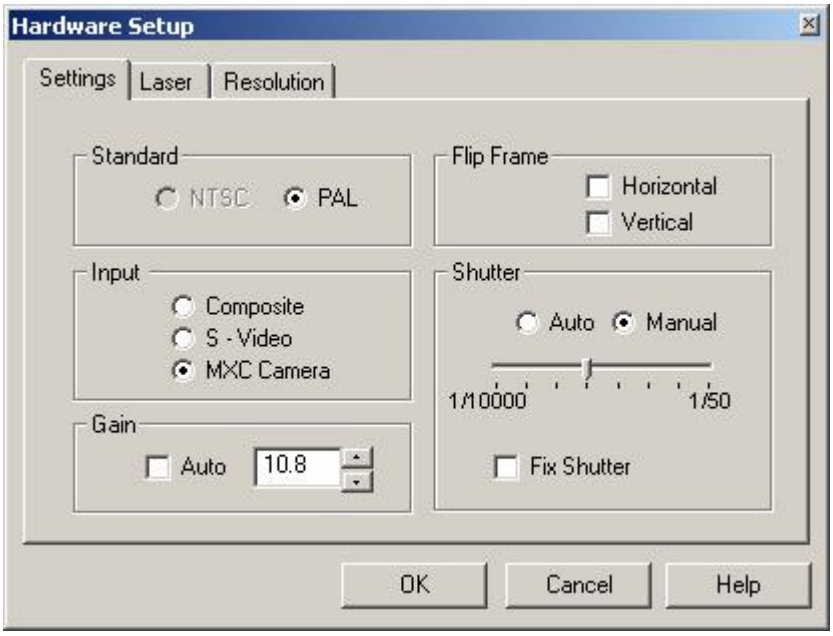


Figure 27 Hardware Setup - Settings Tab Selected

To configure the hardware settings:

1. Click the **Settings** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Standard Type of video equipment:

- **NTSC** - US compatible video equipment.
- **PAL** - European standard video equipment. (This is the default setting for the LBP camera even when it is used in the USA.)

To configure the video equipment type, select NTSC or PAL.

Input Type of video connection:

- **Composite** - RCA-style video connector.
- **S-Video** - S-Video input connector.
- **MXC** - 8-pin video camera connector (This is the default setting for the LBP camera.).

Refer to **Connecting the CCD camera to the PCI card** for more information.

To configure the video connection, select Composite, S-Video or MXC.

Flip Frame Flips the image presentation by 180 degrees.

To flip the image presentation, select Horizontal or Vertical.

Gain Sets the Gain level manually, values range is 6-60dB.

Auto Gain function offers an automatic gain setting, best fitted to the work condition.

Shutter The built-in electronic shutter controls the integration time of each frame. By activating the shutter you control the amount of collected light similar to the way a mechanical shutter controls the exposure time in a regular photographic camera. You select the required shutter speed to prevent saturation and distortion of the measured beam profile. This option is significant for continuous laser beams only.

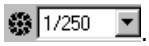
The shutter speed is set manually and is only selectable if you are using the MXC connector. Automatic value setting is a future option.

The possible shutter speeds range from 1/50 to 1/100000 second.

To configure the shutter speed*:*

1. Select **Manual**.
2. Drag the slide bar along the “shutter scale” to select a shutter speed.

Or,

1. From the **Control** Toolbar, select the shutter speed using the drop down list in the shutter field  .

Auto Shutter function offers an automatic shutter setting, best fitted to the work condition

Fix Shutter Refer to **Increasing the camera’s dynamic range**.

In general, use Fix Shutter option to explore faint images below 1% of intensity profile. This function will further activate the double sampling procedure.

7.1.2 Hardware Setup - Laser

Laser configuration allows you to specify the type of laser used and define the synchronization.

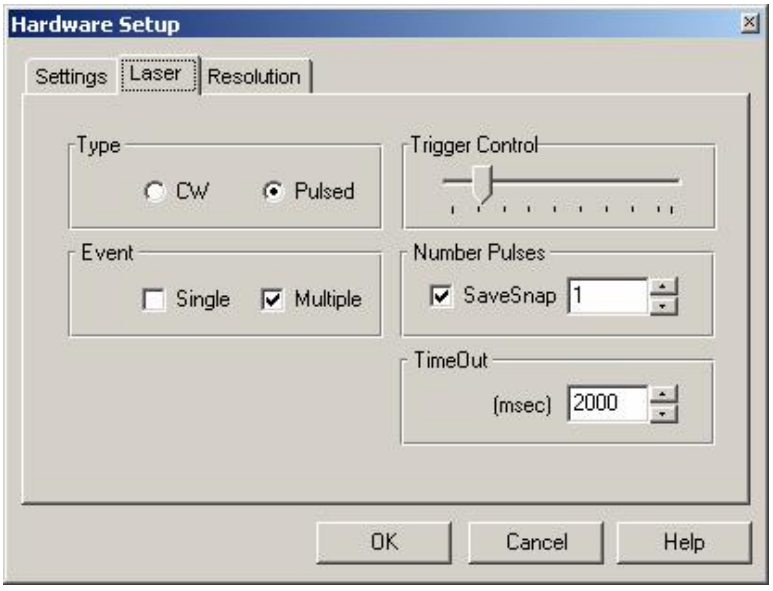


Figure 28 Hardware Setup - Laser Tab Selected

To configure the laser information:

- **Type** - select one of the laser types.
    1. Click the **Laser** tab in Settings, then click **CW** or **Pulsed** and then **OK**, Or
    2. Click on the icon located at the **Status Bar** (when being in continuous mode) so as to get into pulsed mode , and vice versa if you want to get from pulsed to continuous mode.

- **Event** - select one of the following options:

Single - Capture and look at a single shot event. When single shot is activated, the freeze button acts as a run/stop button and can be toggled between Run where the system is ready to capture and freeze the next active frame and Stop where system is frozen with the single shot frame, which has been captured.

Multiple - Capture and save data from a set of pulses, selected via **Number Pulses** parameter. When ending the pulses measurement, statistics of measured pulses are displayed in the Multiple Pulses Data window. In order to view the last measured data set press button from **Analysis Toolbar.**

- **Number Pulses** - Select number of pulses, captured in the multiple events. For every pulse you can save snapshot data.
- **TimeOut** - Select the maximum delay time between pulses.
- **Trigger Control** - This function sets the minimum signal level at which images will be displayed on the screen. It ensures that with pulsed lasers, only frames with images will be displayed.

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

7.1.3 Hardware Setup - Optical Scaling and Resolution

If you are using external optics to reduce or expand the beam size, then set the scaling factor accordingly. After this is done, all values measured by the CCD will be multiplied or divided by the value chosen.

For example, if you are using an optical attachment which reduces the beam size by a factor of 2, choose 2 as the scaling factor and all values read by the camera will be multiplied by 2 to give the true size instead of the size as it is projected on the camera.

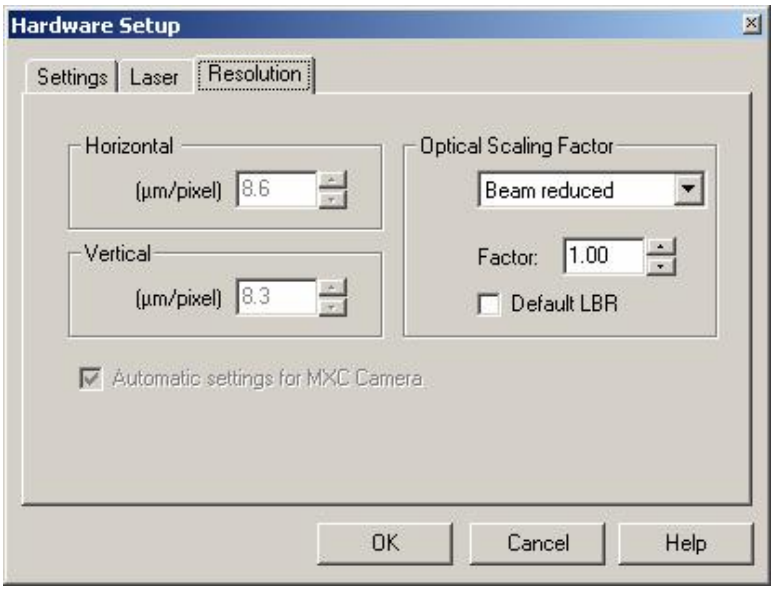


Figure 29 Hardware Setup - Resolution Tab

To set optical scaling:

1. Set the scaling to multiply or divide as needed

2. If using an external optics, one needs to select the appropriate option in **Optical Scaling Factor** (toggle between Beam reduced option and Beam enlarged option). Then select the appropriate Factor parameter accordingly. Default LBR – Laser Beam Reducer with magnification x2.5.

Resolution

The resolution setting is only necessary if you are not using the LBP camera. These values are the resolution parameters (in microns per pixel) of your non-LBP camera.

The LBP camera uses the default values shown in the Horizontal and Vertical fields. Please note that the **Automatic settings for MXC Camera** field is checked.

To configure the resolution:

1. Click the **Resolution** tab.
2. If you are using the LBP camera, select **Automatic settings for MXC camera**.
3. If you are not using the LBP camera, enter your camera's resolution parameters.
4. Click **OK.**

7.1.4 Hardware Setup - Power

The power calibration function allows you to enter a power value as a "base" power level. The power calculation sets the total summed intensity of all the pixels in the subsequent captured samples to be proportional to this value.

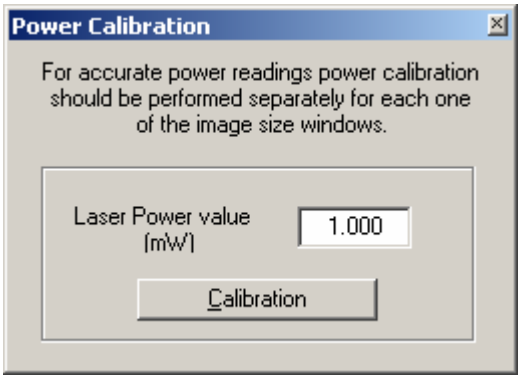


Figure 30 Power Calibration Window

To configure the power settings:

1. Open the **Options menu** and select Calibrations u **Power**.
2. Follow the on-screen instructions.
3. Enter the power value of your laser beam as measured by a reference power meter.
4. Click **Calibration**.
5. Click **OK**.

7.2 Configuring the Software

To configure the software, open the Settings menu and select **System Setup**. The System Setup window displays.

7.2.1 System Setup - Settings

From the Settings tab, you can configure the following information:

- Averaged consecutive measurements.
- Number of still image bitmap files taken during the Still Image function. This is useful only for cases of Pulsed Lasers. This parameter will determine the # of images that will be captured once the Still Image function is activated.

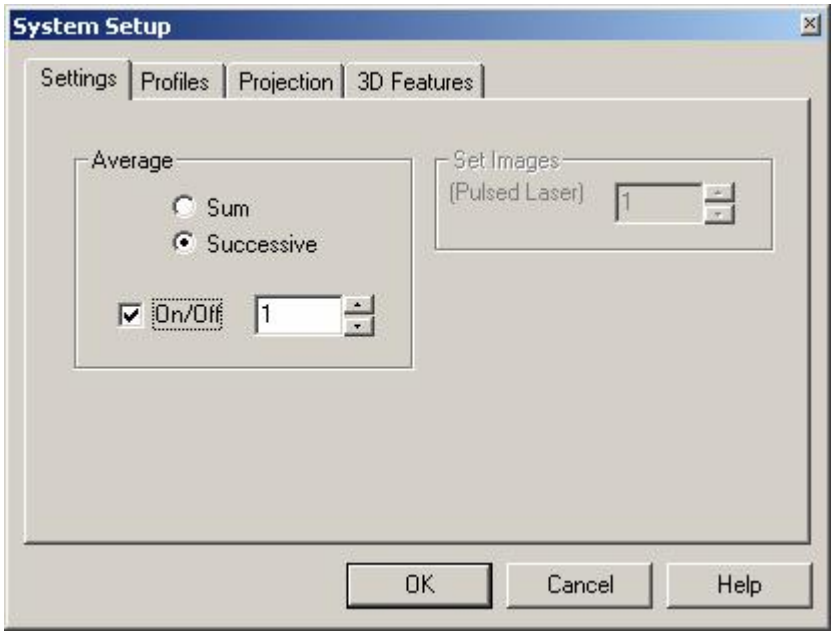


Figure 31 System Setup - Settings Tab Selected

To configure the system settings:

1. Click the **Settings** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Average Used to smooth the data display of quickly varying sources.

When using a beam with a significant amount of jitters, set this feature on. The LBP takes a user defined number of successive measurements. These measurements are averaged and displayed. When Average in On, and mark is set to the "Sum" field, a few images are averaged and their summation average is displayed at a lower frame rate, according to the number of averaged images.

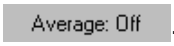
For example, you choose a value of 10, ten consecutive measurements are averaged and the result is displayed. When an eleventh measurement is taken, the first measurement value is dropped and the second through the eleventh are averaged, etc.

Because a successive averaging technique is employed, the window display update rate is only slightly affected, if at all.

***NOTE**: The Average function only affects the numerical data and not the picture. The picture is not averaged.*

To smooth the data display:

1. Select **On/Off** to activate. Or,

   From the **Status Bar**, click 

. The System Setup window displays.

2. Enter a successive measurement value. Possible values are 1-20, where 1 means no averaging and each measured value is displayed.

Set Images Sets the number of still image bitmap files that the system takes during pulsed laser operations.

If, for example, you input 4 and select the still image function, the system captures and saves the next 4 still images.

The set images function is disabled for continuous lasers.

To set the number of still image bitmap files, enter a set image value. Possible values are 1 - 12.

7.2.2 System Setup - Profiles

Profiles setup allows you to control the display in the profiles area.

You can control the following displays:

- Profile type display
- Vertical and horizontal profiles
- Gaussian / Top Hat profile
- Background color
- Clip levels
- Angle of rotation at which the X-Y cross-section profiles are cut.

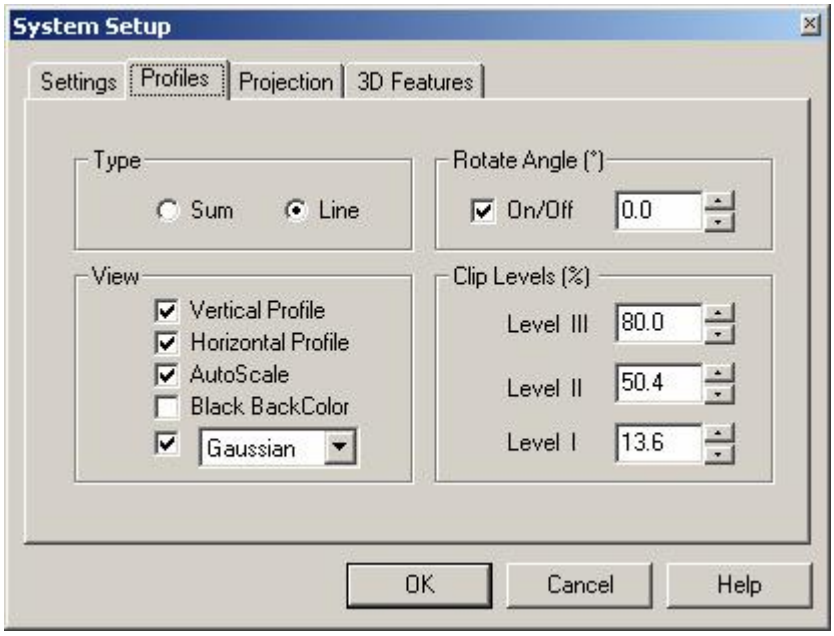


Figure 32 System Setup - Profiles Tab Selected

To configure the profiles:

1. Click the **Profiles** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Profile Type The following methods for profiles calculations are available:

- **Sum Profiles -** Displays the two orthogonal profiles, one along the vertical axis and one along the horizontal axis. Each profile is composed of a summation of rows and columns at a beam cross-section.
- **Line Profiles -** Displays the contour of the beam along a line parallel to the vertical axis and a line parallel to the horizontal axis. The two lines, along which these contours are displayed, are designated as a cross hair cursor. The cross hair cursor can be moved along the image screen, so that the displayed profile is the cross section line profile located by the cursor.

To select the profile calculation method:

1. Select Sum or Line. Or,

   From the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles. Or,

   Open the View menu and select Profiles u **Sum** or **Line**.

To select the angle at which you want to cut the X, Y profiles:

Click on the On/Off of **Rotate Angle** and select the angle desired from –45 to +45 degrees. The allowed increments are 0.1 degree.

View

Controls the following profile displays:

- **Vertical Profile, Horizontal Profile** - Displays the profiles from two orthogonal axis (horizontal and vertical). Each image is a digital representation of the spatial power distribution across the beam. The angle at which the profile is cut is controlled by profiles/rotate angle (see above). The numerical value of the profiles can also be saved and printed.
- The **Gaussian** fit profile shows how closely the measured beam profile matches a Gaussian profile. The Gaussian fit profile is displayed on top of both the vertical and horizontal profiles in red.

  The Gaussian Fit is a least-squares fit of a Gaussian equation to the cross section beam profiles. The correlation coefficient is the normalized sum of the fit residuals. The following equation is used for the Gaussian Fit calculation:

  $$I = Ve \wedge [-(x-c)/s\ ]^2$$

  Where
  I = the intensity of a pixel at location x
  V = the maximum intensity of the fitted Gaussian curve (Peak Intensity)
  C = the center of the Gaussian fit peak (Centroid)
  σ = the radius of the Gaussian fit curve at the $1/e^2$ intensity level (diameter)
- **Auto Scale -** Displays the profiles using the full height of the profile window.

  When Auto Scale is not selected, the beam peak can be observed as it changes which can be advantageous during a focusing process. The peak intensity changes may be observed as a function of the focus, showing the variations in beam's peak with respect to the changes in beam size.

  This function affects only the graphical presentation in the profile area.
- Black Back Color sets the background color for the profiles area to black (default is white).
- **Gaussian/Top Hat** selects between Gaussian or Top Hat calculation and display. The display of the best fit Gaussian or Top Hat profile is overlaid in red on top of the profiles in real time

To configure the profile view, select the desired options.

Clip Levels Sets the levels at which the width of the vertical profile and horizontal profile are measured by the system.

A clip level defines the percentage of the peak intensity profile at which the beam is measured. For example, a clip level of 50% indicates that the beam is to be measured at its full width at half maximum (FWHM), whereas a clip level of 13.5% measures the beam at a point, which is 13.5% of the profile peak. The 13.5% level corresponds to the 1/e2 point of a Gaussian profile.

Both the horizontal and vertical profile windows display the width of the beam at three clip levels simultaneously.

There are three clip levels represented by solid horizontal lines superimposed on the profiles. The default clip levels are 80%, 50% and 13.5%.

The three clip levels are labeled I, II and III.

To change the clip levels:

1. Enter a value in the **Clip Level** field. The clip levels values are in 0.1% increments. Or,

1. In the profiles area, position the cursor just above (or below) the width level bar you want to change.
2. Press the left mouse button and drag the line up or down, while watching the change in the clip level setting on the profile presentation. The new clip levels can be seen in the Measurement Data window. When performing this operation it is helpful to size the profiles area as large as possible.

7.2.3 System Setup - Projection

Projection setup allows you to control the display of the image area.

Displays you control include:

- 2D or 3D graphic images
- Zooming factor
- Graphic image magnification
- Color or monochrome display
- Image size

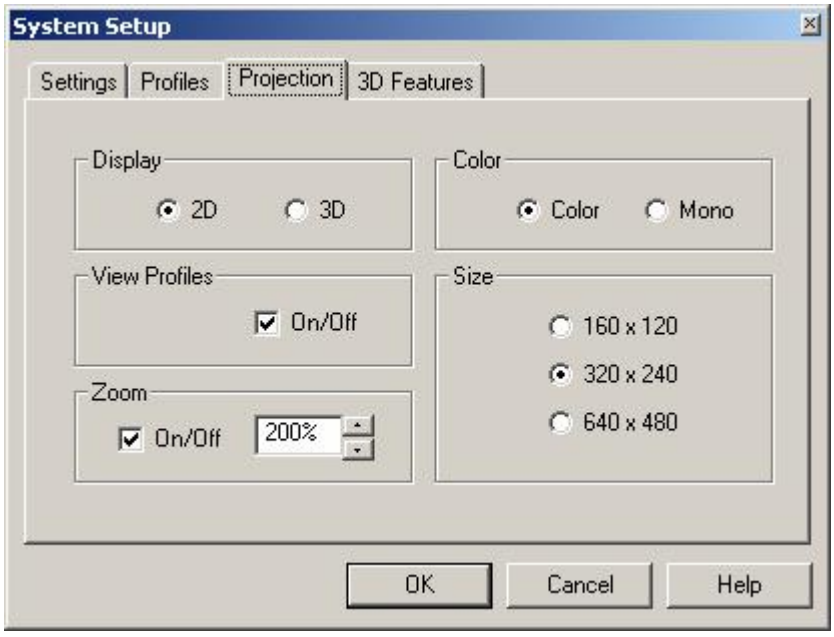


Figure 33 System Setup - Projection Tab Selected

To configure the projection:

1. Click the **Projection** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Display

Toggles between a 2D or 3D graphical presentation in the view area.

To select the graphical presentation*:*

1. Select **2D** or **3D**. Or,

   From the **Control Toolbar**, click  for a 2D display or  for a 3D display. Or,

   Open the View menu and select Projection u **2D** or **3D**.

View Profiles

Enables/disables the display of the cross section beam intensity profiles in the view area.

To display the cross section beam intensity, select **On/Off**.

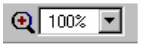
Zoom

Enables magnification of the image displayed in the view area.

When zooming in or out, the system centers the plot as close as possible over the current crosshair cursor position.

To magnify the image*:*

1. Select **On/Off**. Or,

   From the **Control Toolbar**, click 

2. Select the magnification you desire (100% is normal size).

Color

Select the graphical presentation's background color. You can choose either colored or black and white (mono).

To select the background, select **Color** or **Mono***.*

Size

Sets the view area size. The selected frame size is displayed on the **Status Bar**.

To set the view area size:

Select a predefined size.

176x144, 352x288 or 720x576

7.2.4 System Setup - 3D Features

The 3D features setup defines the attributes for the 3D isometric presentation.

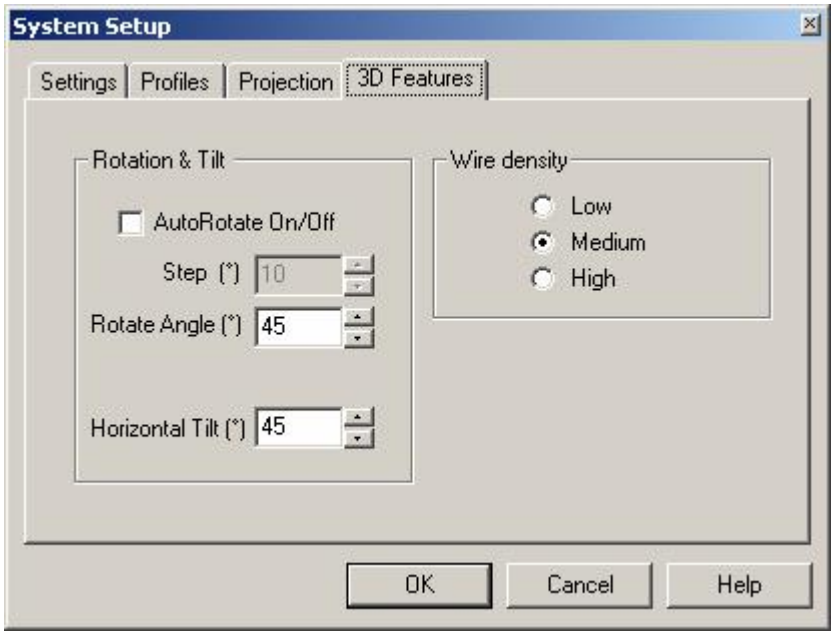


Figure 34 System Setup - 3D Features Tab Selected

To configure the 3D features:

1. Click the **3D Features** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Rotation & Tilt

This function is used to change the viewing angle of a 3D graphics presentation. This enables you to view the angles around the beam's main axis as well as to flip the displayed image.

- **Auto Rotate On/Off** - When Auto Rotate is on, the image is rotated about the optical axis or azimuth of the 3D display. The amount of rotation (viewing angle) is defined by the Step parameter (in degrees). Possible values for Step are 1 through 30 degrees. When Auto Rotate is on, Rotate Angle is disabled.
- **Rotate Angle (°)** - Sets the viewing angle of the 3D projection display. Possible values are 1 through 360 degrees in 1 degrees increments.
- **Horizontal Tilt (°)** - Sets the tilt viewing angle of the 3D projection (from a top view to a side view). The values range from 0 to 90 degrees in 1 degree increments.

To set automatic rotation:

1. Select **AutoRotate On/Off**.
2. In the Step field, enter the viewing angle.

To set manual rotation:

1. Deselect **AutoRotate On/Off**.
2. In the Rotate Angle (°) field, enter the viewing angle.

To set manual tilt:

1. In the Horizontal Tilt (°) field, enter the tilt angle. Or,
2. Place the cursor over the image and press the left mouse button. The cursor changes shape.
3. Drag the cursor along the view area. The 3D plot rotates around the image main axis and flips from top view to a side view of the image.

Wire density

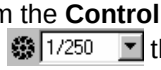
Controls the graphical presentation of the 3D plot by means of line density. There are three wire densities to choose from: Low, Medium and High. High density displays the best graphics for the 3D image, as the color lines are condensed, but as the graphics become more complex, it takes more time to draw the image on the screen.

To set the Wire density, select the desired wire density.

7.2.5 Configuring a Continuous Laser Beam

When using a continuous laser beam, attenuate powerful laser beams by selecting a combination of shorter shutter speeds and attaching the ND filters to the LBP camera until the saturation level is acceptable. Refer to **Hardware Setup - Shutter** and **Using Filters** topics for more information.

To configure a continuous laser beam:

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **CW** radio button in the **Type** field.
3. From the **Control Toolbar**, select a shutter speed using the drop down list in the shutter field 

that enables an acceptable saturation level.
4. From the **Control Toolbar**, select a gain level using the drop down list in the gain field that enables an acceptable saturation level.
5. If the image is still saturated at the fastest shutter speed or gain selected, attach ND filters to the LBP camera until an acceptable saturation level is reached.

7.2.6 Setting the Ambient Light Suppression (CW lasers)

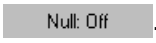
The **Null** function allows you to subtract off background and display the correct power value.

When null calibration is off, the power value displayed in the measurement data or statistics window is the total power incident on the detector surface. When null calibration is on, the power value displayed does not contain the ambient light.

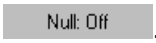
You should perform the null calibration function during your set up routine. During the null calibration routine, a message is displayed at the top right side of the screen, which reads: **Null Calibration**.

To calibrate the ambient light suppression:

1. Open the **Options** menu and select Calibration u **Null.** Or,

   From the **Status Bar**, click 

.

   A message displays instructing you to turn off your laser beam.
2. Turn off or block your laser and click **OK**. The system now measures the ambient light level. Note that the power reading in the Measurement Data area is now zero.
3. Turn on or unblock your laser. The Null button on the **Status Bar** changes to 

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7.2.7 Configuring a Pulsed Laser Beam

When using a pulsed laser beam:

- Attenuate powerful laser beams by attaching the ND filters to the LBP camera until an acceptable saturation level is reached. Refer to **Using Filters** topic for more information.

- Set the gain setting to the optimum for displaying a full dynamic range without saturation (white on the image).

- Set the trigger level. This allows you to measure slowly pulsing lasers without displaying blank frames.

To configure a pulsed laser beam:

1. Click on the icon at the **Status Bar** if in continuous mode so as to get into pulsed mode
2. Select the slowest shutter speed (1/50s).
3. Attach ND filters to the CCD camera until an acceptable saturation level is reached.
4. Further adjust the intensity level using the gain control
5. Adjust the trigger level using the icon until you get a steady reading. It is best to move to the right until triggering stops, then move back a little.

7.2.8 Using Filters

When setting up your system, use the three calibrated optical filters (ND filters) supplied with the LBP system to attenuate powerful beams. By doing so the amount of energy, which the LBP camera is sensing, is significantly smaller. The use of filters is especially significant when operating a pulsed laser beam.

To attenuate powerful-pulsed laser beams, attach filters to the LBP camera until the saturation level is acceptable. The LBP camera is supplied with a filter wheel having room for 4 stackable filters. Three different filters are supplied, which are:

- 1.6mm thick Schott colored filter NG4
- 1.6mm thick Schott colored filter NG9
- 1.6mm thick Schott colored filter NG10.

See curves of optical filters in Appendix section. You can order more filters if desired.

The filter type is marked on the filter housing according to the following schematics:

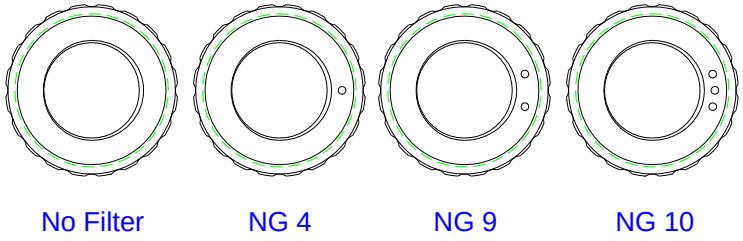


Figure 35 Filter type marking

To attenuate powerful continuous laser beams, select a combination of shorter shutter speeds and attaching filters to the LBP camera until the saturation level is acceptable.

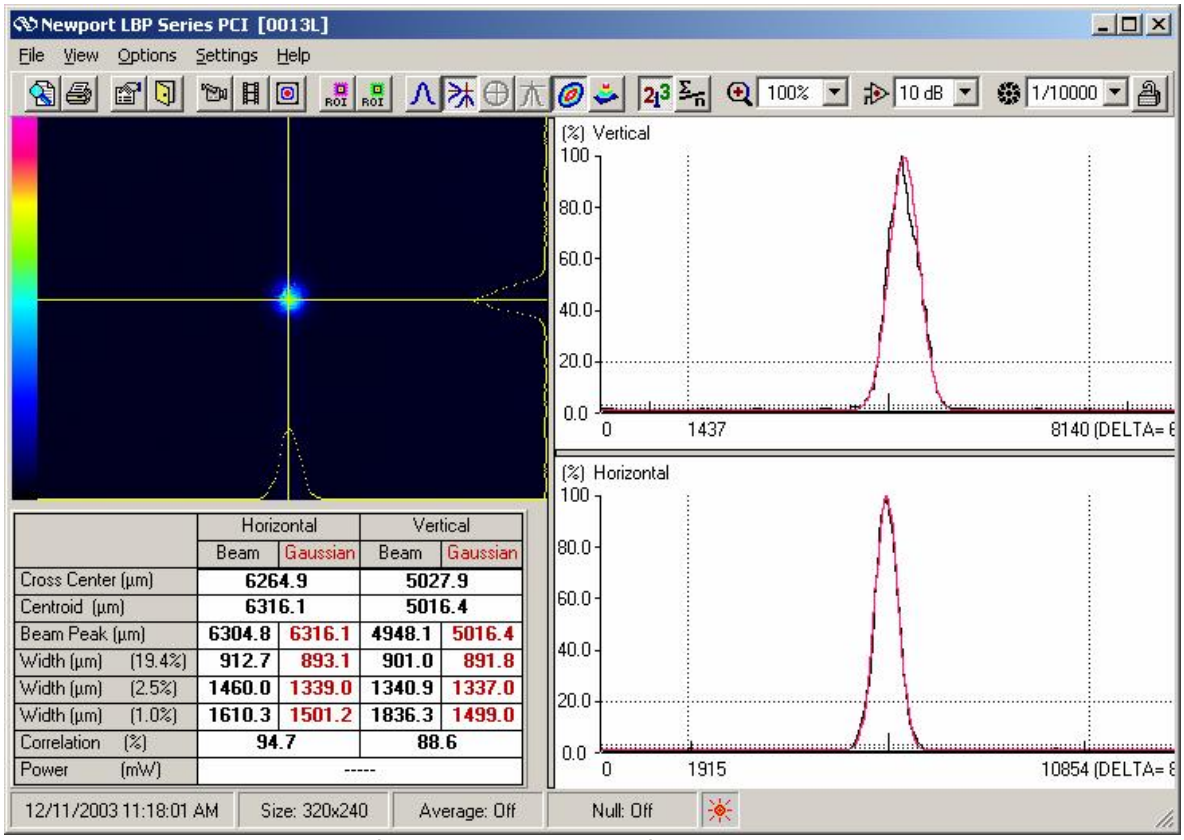
Refer to **Configuring a continuous Laser Beam** for more information.

7.2.9 Increasing the Camera's Dynamic Range

Fix Shutter permits revealing and accurate measurement of faint phenomena at the profile basis when using a continuous laser beam. It increases the camera's dynamic range by a factor of up to 100 by analyzing the beam profile using two images with two different exposure times.

Activating Fix Shutter fixes the first image as the reference image for further measurement. By scrolling and increasing the shutter's exposure time, the collected power of the LBP is significantly higher than in the reference image. This situation causes some pixels to be saturated, while some other pixels, which originally were attenuated to below digitization level, are now clearly displayed, revealing hidden structures at the profile base. The system will automatically toggle between the two images and present the saturated profile readings and calculations referred to by the original reference shutter. The collected power of each pixel is directly proportional to the different integration times, and the displayed profile is automatically corrected by this proportional factor.

Fig. 32 shows an image with no saturation and thus no faint phenomena at the image basis. The vertical profile and horizontal profile display showing the beam profile in a selected row and column.



	Horizontal		Vertical	
	Beam	Gaussian	Beam	Gaussian
Cross Center (µm)	6264.9		5027.9	
Centroid (µm)	6316.1		5016.4	
Beam Peak (µm)	6304.8	6316.1	4948.1	5016.4
Width (µm) (19.4%)	912.7	893.1	901.0	891.8
Width (µm) (2.5%)	1460.0	1339.0	1340.9	1337.0
Width (µm) (1.0%)	1610.3	1501.2	1836.3	1499.0
Correlation (%)	94.7		88.6	
Power (mW)	-----			

Figure 36 Non-Saturated Image

Fig. 33 below displays the same image except a different shutter selection greatly increased the integration time, and a new high-resolution picture is created. This picture is a mathematical combination of the first non-saturated image with the new image that reveals faint phenomena. In the View Area you can clearly see faint phenomena (watch the area

around the crosshairs), and both the horizontal and vertical profiles provide information related to the faint image.

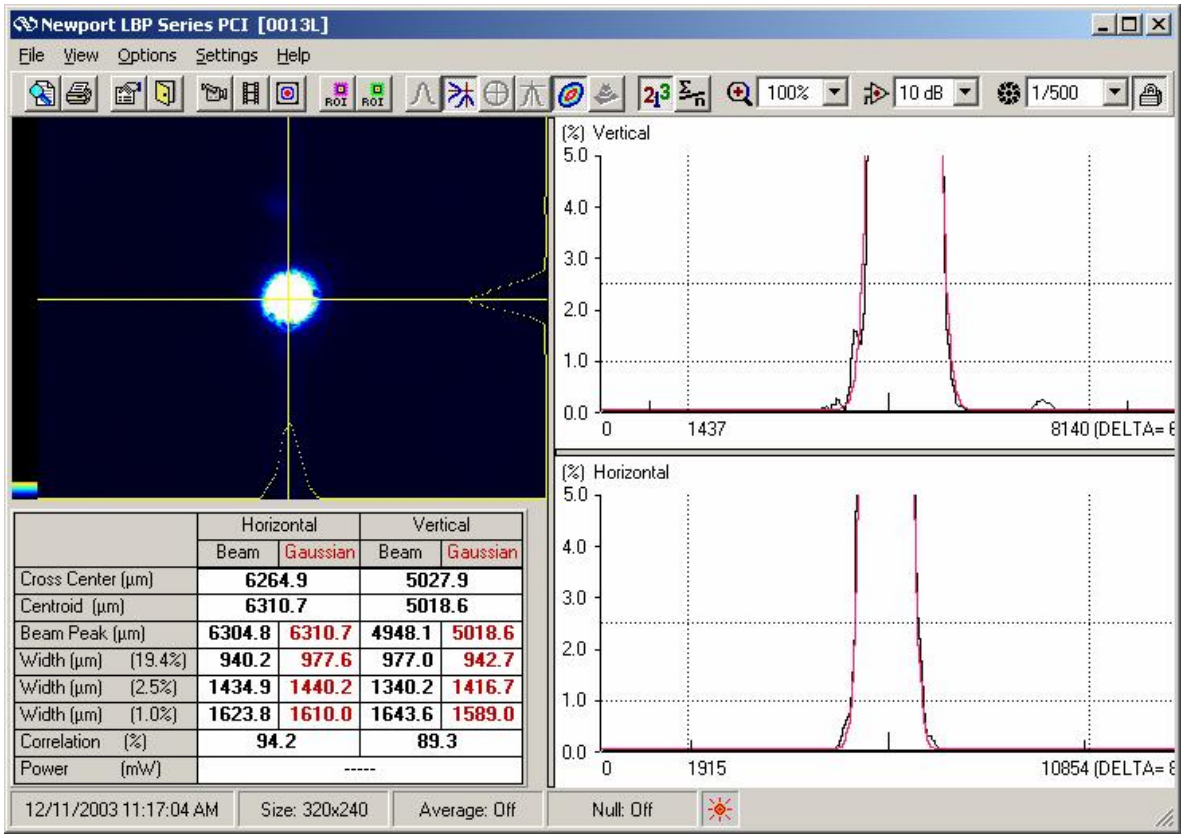
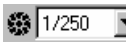


Figure 37 Saturated Image

To use fix shutter:

1. From the **Control Toolbar**, click  for a 2D display.
2. Scan the beam when there is a non-saturated image.
3. From the **Control Toolbar**, click  . Or,

4. Open the Settings menu and select **Hardware Setup**.
5. Click the **Settings** tab.
6. In the **Shutter** field, select **Fix Shutter**.

   The LBP will ensure that Line Profile mode is selected.
7. From the **Control Toolbar**, select a slower shutter speed using the drop down list in the shutter field  .
8. In the View Area, move the Line Profile crosshairs to the beam image's edges. In the View Area you can see faint phenomena (refer to the area around the crosshairs), and both the horizontal and vertical profiles provide information related to the faint image.

To end the Fix Shutter function, from the **Control Toolbar** click  .

8.0 General description of Software

This chapter discusses the following LBP operations:

- Viewing Beam Profiles and Width
- Viewing the Centric
- Viewing the 2D / 3D presentations
- Viewing Power
- Viewing the Beam Peak
- Viewing Measurement Data
- Viewing the Statistics
- Freezing Screen Graphics
- Printing Screen Displays
- Saving Screen Graphics
- Working with Stored Files

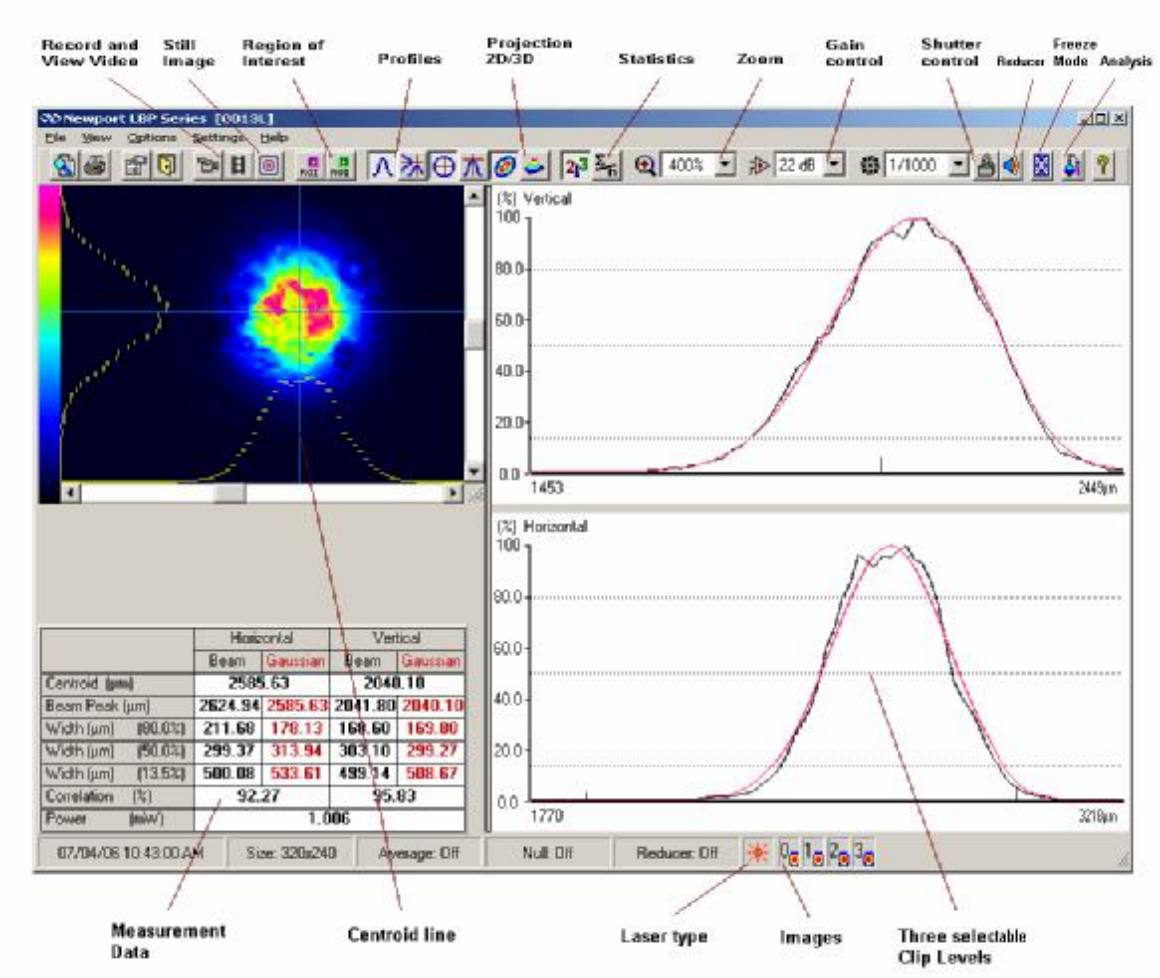


Figure 38 LBP Application Window

8.1 Viewing Beam Profiles and Width

Two types of profiles are being displayed by LBP:

Sum Profiles- Displays the two orthogonal, one along the vertical axis and one along the horizontal axis. Each profile is composed of a summation of rows and columns at a beam cross-section.

Line Profiles- Displays the beam contour along a line parallel to the vertical and horizontal axes. These two orthogonal lines are designated as a cross hair cursor on the image plane and can be moved along the working area.

1. To select the profile calculation method:

From the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles. Or,

Open the View menu and select Profiles u **Sum** or **Line**.

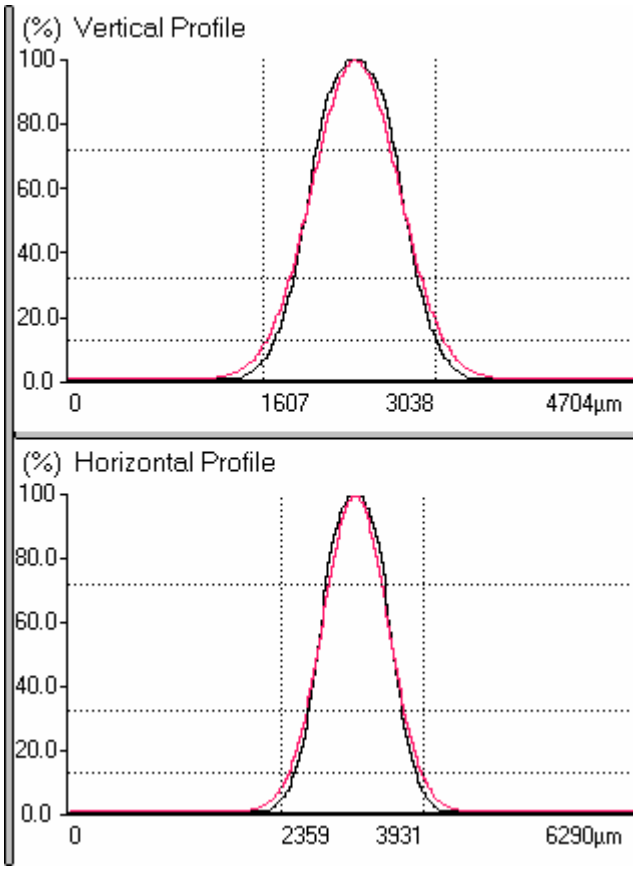


Figure 39 Profiles

Beam widths are digitally displayed for any three user selected clip levels.

A Gaussian fit profile can be overlaid on profiles in real time, while the correlation and fit values are displayed digitally. This function determines how closely the measured beam profile matches a theoretical Gaussian profile. The Gaussian fit profile is in red. The percent correlation and width comparisons utilize the currently selected clip levels.

Two vertical bars can be moved along the horizontal axis, designating the distance (in microns) along this axis. This is a useful feature for tracing and measuring of beam phenomena at certain locations.

The comparison data is displayed in the Measurement Data Box. A top hat profile presentation and fit is also available.

	Horizontal		Vertical	
	Beam	Gaussian	Beam	Gaussian
Cross Center (µm)	2968.06		2058.00	
Centroid (µm)	3144.96		2352.00	
Beam Peak (µm)	3144.96	3144.96	2332.40	2352.00
Width (µm) (80.0%)	253.62	257.92	262.81	263.54
Width (µm) (50.0%)	459.83	454.57	461.41	464.49
Width (µm) (13.5%)	785.83	772.64	795.46	789.49
Correlation (%)	98.05		99.01	
Power (mW)	1.000			

Figure 40 Measurement Data.

8.2 Viewing the Centroid

The Centroid is the beam intensity center of gravity.

The LBP determines the location of the beam centroid by summing the intensities of all image pixels in both horizontal and vertical axes, and computing the center of gravity of the beam intensity. The pixel coordinates at this location define the centroid. The horizontal (H) and vertical (V) coordinates of the Centroid are computed using the following formula:

$$H = \mathring{a}\{h * i(h,v)\} / I$$

$$V = \mathring{a}\{v * i(h,v)\} / I$$

Where
i(h,v) = the intensity at location (h,v)
I = the total intensity taken over the total area

The centroid calculation is displayed in the Measurement Data window and Statistics windows. Refer to **Viewing Measurement Data** and to **Viewing the Statistics** topics for more information.

The LBP enables you to display the centroid in the view area when a 2D image is displayed. The centroid is located where the horizontal and vertical profiles cross in the view area. Two additional regions of interest (ROI) can be defined by the user and displayed at the Statistics table, thus enabling the user to monitor up to 3 beams' centorids simultaneously.

To display the centroid in the view area:

1. From the **Control Toolbar**, click  for a 2D display.
2. From the **Control Toolbar**, click  for a sum profiles display.
3. Open the View menu and select **Centroid**, Or

   From the **Control Toolbar**, click  .

8.3 Viewing the 2D / 3D Presentations

The projection function provides either a 2D or a 3D plot of the beam intensity profile. A zooming feature enables magnification of the displayed image. It is possible to control the 3D plot wire density.

To display the 2D presentation in the view area:

From the **Control Toolbar**, click  for a 2D display.

To display the 3D presentation in the view area:

From the **Control Toolbar**, click  for a 3D display.

The 3D image can be rotated along the vertical and horizontal axes, as well as be flipped, using the following routine. This feature enables the user to view the beam image from various angles around the beam:

- Place the mouse cursor over the 3D image
- Hold the left mouse button down
- Drag the mouse while pressing the left mouse button. You can move the cursor up/down or left/right. The image will rotate accordingly.

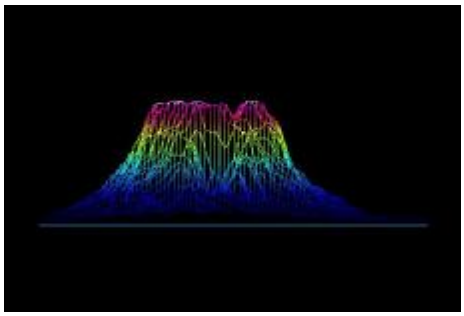


Figure 41 3D Plot – Side View

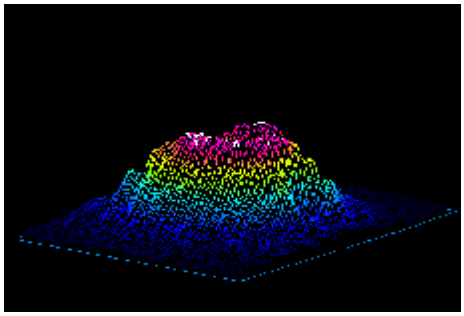


Figure 42 3D Plot – Top View

If beam is weak even when shutter is wide-open then increase the gain. If beam is very weak and color is dark even at the maximum shutter opening and gain, then optimize the color with the side panel. To optimize beam image place mouse cursor at the color bar and click the right mouse button. Return to default color bar press left mouse button once. (See illustrations below).

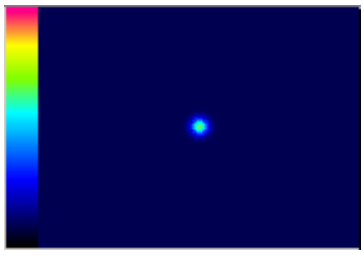


Figure 43 Weak beam

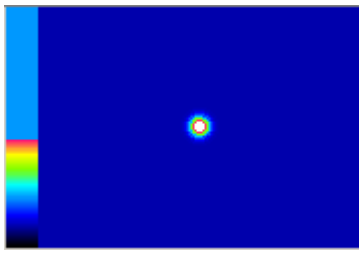


Figure 44 Weak beam with optimized color

8.4 Viewing Power

The beam power is displayed as a digital readout at the Measuring Data box.

A power calibration function allows the user to enter a “base” power value. In all subsequent captured images the summed intensity of all pixels will be proportional to this value.

8.5 Viewing the Beam Peak

The beam peak calculation provides the position of the peak intensity in the captured beam image.

The beam peak intensity location is found by searching all the pixels in a scanned sample for the maximum digital intensity level. The location of the pixel with maximum intensity is the peak location. It is possible that more than one pixel is found at the maximum intensity signal. In this case, the peak location will be the peak intensity pixel which is found first. The search is conducted by scanning the image from left to right, top to bottom.

The beam peak calculation is displayed in the Measurement Data window and Statistics windows. Refer to **Viewing Measurement Data** and to **Viewing the Statistics** topics for more information.

The LBP enables you to display the beam peak in the view area when a 2D image is displayed. The beam peak is located where the two diagonal black lines cross in the view area. Two additional regions of interest (ROI) can be defined by the user and displayed at the Statistics table, thus enabling the user to monitor up to 3 beams’ beam peaks simultaneously.

To display the beam peak in the view area:

1. From the **Control Toolbar**, click  for a 2D display.
2. From the **Control Toolbar**, click  for a sum profiles display.

   Open the View menu and select **Beam Peak**, Or

   From the **Control Toolbar**, click  .

8.6 Viewing Measurement Data

The LBP enables you to view real-time measurement data. The measurement data includes:

- The cross center (for Line Profile Mode only – Cross location)
- The beam centroid
- The beam peak
- The beam width measurements at 3 selected clip levels for measured beam and Gaussian profile
- The correlation factor to the ideal Gaussian beam
- The beam power

The Measurement Data window is located by default just below the image area, but you can move it anywhere on the screen.

The Measurement Data window contains the following information:

Cross center	The cross-center coordinates – for Line Profile Mode only (µm).
Centroid	The beam intensity center of gravity (µm).
Beam Peak	The position of the peak intensity in the captured beam image (µm).
Width	The width comparisons of measured beam and Gaussian beam are located at the current selected clip levels (µm).
Correlation	The deformation calculation from the ideal Gaussian beam (%). Given a theoretical curve (G) and a set of data points from a beam profile (P), where each data set is composed of points for j=0, 1, 2, … N. The correlation coefficient is derived from the following steps: 1. S = Integral [$(P-G)^2$] where S = the integration of the squared differences between the two curves. 2. So = Integral [$(G)^2$] where So = the deformation at each point from the average, Dj. 3. C = 100 * { 1 – [SQRT (3/S-So)]} where C = the fit coefficient percentage.
Power	The power of the laser beam measured in mW.

The beam column displays the laser beam's readings. The Gaussian column displays the data of the ideal Gaussian profile.

These measurement results are calculated and displayed for both the Horizontal and the Vertical profile.

The Measurement Data window can be viewed off-line in stored snapshot images for further analysis. Refer to **Creating / Viewing Snapshot Files**.

To view the Measurement Data window:

1. If the **Statistics** window is displayed, open the View menu and select **Statistics**. Or,

   From the **Control** Toolbar, click  .
   The **Statistics** window is not displayed.

2. Open the View menu and select **Measurement Data**. Or,

   From the **Control** Toolbar, click  .
   The **Measurement Data** window displays.

NOTE: *When the Statistics window displays, the Measurement Data window is hidden.*

To move the Measurement Data window:

1. Position the cursor on the blank area on the top corner of the Measurement Data window.
2. Press the left mouse button and drag the Measurement Data window to the desired location.

8.7 Saving and Viewing the numerical data of the profiles

The LBP allows you to save, view and print the numerical values of the X and Y profiles for later analysis.

To View the numerical data of the X and Y profiles:

3. Place the X and Y crosshairs at the angle and position you desire.
4. Press **Options** menu, **Save data in text file**, **Profiles** option.
5. Name the text file and save with the TXT extension. The data will be saved as a text file with the relative X and Y intensity vs. pixel number. The setup data will be saved at the same time.
6. To view the data, press **File** menu, **View file** option and the view file window will open. Under Files of type select snapshot files and double click on the desired TXT file. If you want to print the file when open, press **Print**.

8.8 Viewing the Statistics

The information in the Statistics window is useful for analyzing beam stability related characteristics. The statistics can help you monitor fluctuations and beam stability of the images captured and stored in the data buffer or analyze the warm-up characteristics when measuring beam-pointing stability.

- Current - the actual measurement values
- MIN - the minimum measured value
- MAX - the maximum measured value
- AVER - the average value
- STD - the standard deviation

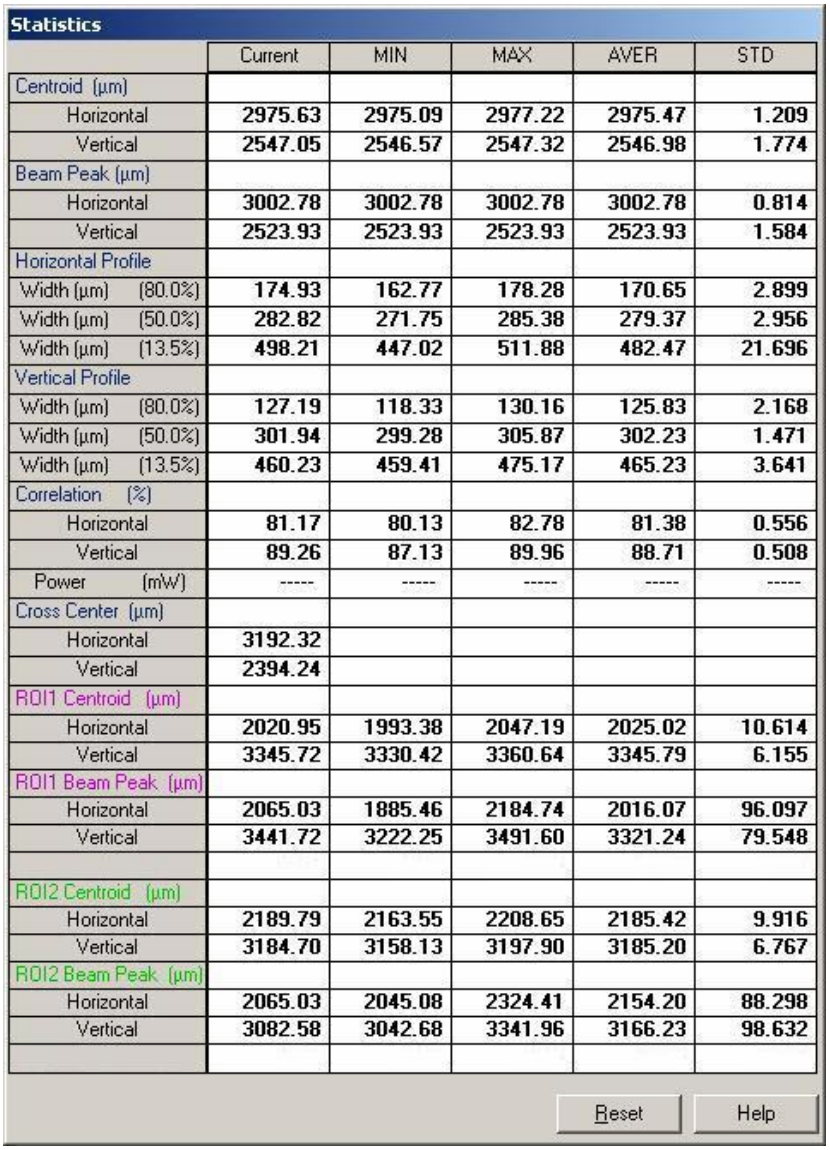


Figure 45 Statistics Window

To view the Statistics window:

1. Open the View menu and select **Statistics**. Or,

   From the **Control Toolbar**, click  .

You can reset the parameters in the statistics window to initiate a new statistics calculation session. To reset the parameters in the Statistics window, press the **Reset** button.

 ***NOTE:*** *When the Statistics window displays, the Measurement Data window is hidden.*

8.9 Freezing Screen Graphics

It is possible to freeze the last image display and its measured data for further analysis using the Analysis function. You can perform the following functions on the frozen data:

- Viewing ellipse presentation (refer to page 71)
- Calculating a beam footprint (refer to page 71)
- Measuring distances between two points (refer to page 72)
- Viewing the measurement data (refer to page 64)
- Viewing the Statistics (refer to page 67)

When the LBP is in freeze mode, a message displays on the top left-hand side of the screen, which reads: **Freeze Mode**.

To freeze the screen graphics:

1. Open the Options menu and select **Freeze Mode**. Or,

   Click  on the **Control Toolbar**. A Freeze Mode message appears on the menu bar.

To return to real-time measurement mode:

1. Open the Options menu and select **Freeze Mode**. Or,

   Click  on the **Control Toolbar**. The Freeze Mode message disappears from the menu bar.

8.10 Printing Screen Displays

This section describes how to print:

- The LBP window
- The view area (2D/3D image only)

To print the LBP window, open the File menu and select **Print Screen**.

To print the view area, open the File menu and select **Print Frame**.

8.11 Saving Screen Graphics

The LBP 's screen graphics are saved as image files, which you can view, edit or print at a later time.

To save screen graphics:

1. Open the Options menu and select **Save Image File**. A sub-menu displays.
2. Select the screen section to be saved: Frame (view area), Profiles, Statistics or Full Screen. The **Save Image File** window displays.
3. Enter a filename and file extension (BMP or JPG) for the saved screen graphic.
4. Click **OK**.

☞ ***NOTE:*** *You can only save graphics, which appear in the LBP window. For example, if the Statistics window is not displayed, the Statistics option is disabled.*

8.12 Working with saved Files

You can view or print stored LBP files.

Viewing Files

To view a file:

1. Open the File menu and select **View File**, Or

   Click  , from the **Control Toolbar**.

   The **View File** window displays.
2. In the **Files of Type** field, select the file type.
3. Select the file. Click **OK**.

Printing Files

LBP provides you with the ability to print a saved text or image file.

To print a text or bitmap file:

1. Open the File menu and select **Print**, Or

   From the **Control Toolbar**, click  .
2. Select the file type for the file you want to print **Text** or **Image**. If you select Text, the **Print Text File** window displays. If you select Image, a menu appears for selecting **Print Image File** window (select BMP or JPG file).
3. Select the file you want to print. Click **OK**.

9.0 Analysis Functions

This chapter includes the following:

- Testing the beam
- Calculating a beam elliptical footprint
- Measuring distances

9.1 Test

LBP provides a test routine, which allows you to test a laser beam based on user defined pass/fail criteria. The test results are calculated for any one of the following user-selected parameters:

- Centroid Horizontal (µm)
- Centroid Vertical (µm)
- Width Horizontal (µm) at the lowest clip level
- Width Vertical (µm) at the lowest clip level
- Gaussian Width Horizontal (µm) at the lowest clip level
- Gaussian Width Vertical (µm) at the lowest clip level
- Correlation Horizontal (%)
- Correlation Vertical (%)
- Power (mW)

To test a laser beam:

1. Open the View menu and select Toolbars u **Analysis**. Or,

   From the **Control Toolbar**, click  .

   The **Analysis Toolbar** displays.

2. To run the test, click  on the **Analysis Toolbar**.
3. Select the parameters to include in the test and set the minimum and maximum values for these parameters.
4. Enter your test related information.
5. Click **Test** button to perform a test routine.

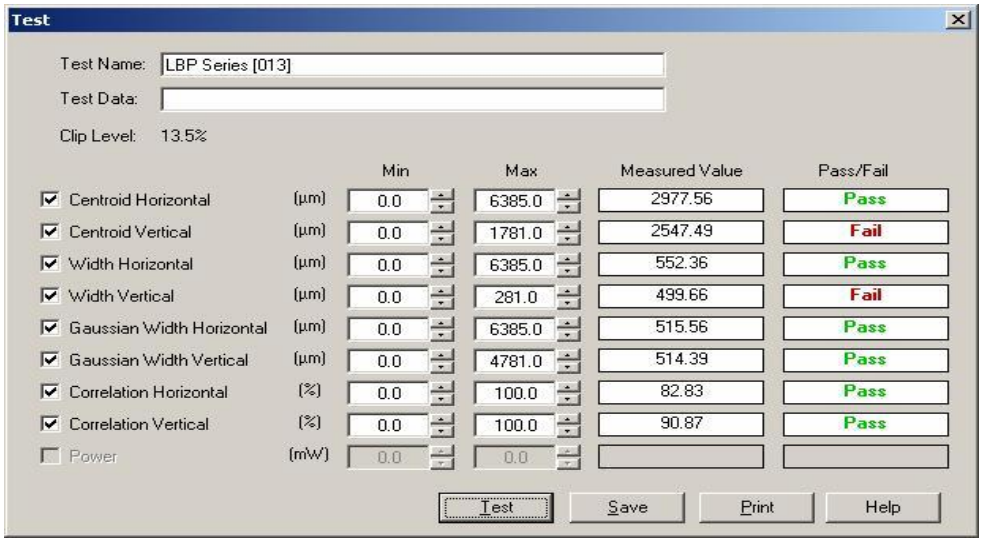


Figure 46 Test Window

The test window displays the beam's test results based on the parameters entered in the Test window.

To save the current test results in a bitmap or test file, click **Save** in the Test window.

To print the current test results, click **Print** in the Test window.

To close Test window click  on the **Analysis Toolbar**.

9.2 Calculating a Beam Footprint

Analyzing a laser beam frequently requires a definition of beam elliptical footprint in the profile cross-section plane, and beam angular orientation with respect to the camera axis. The ellipse function calculates the best-fit ellipsoid for the examined beam. The major and minor axes of the fit ellipse are calculated by determining the distance from the centroid (center of the beam) to the ellipse. Also, the orientation (Theta θ) is a measure of the orientation of the major axes of the fit. Theta is measured from the positive X-axis and varies between +90° and –90°.

To use the ellipse function the image must be frozen. The LBP can now calculate the best-fit ellipse and display it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are also calculated and displayed.

To calculate a beam elliptical footprint:

1. Open the Options menu and select **Freeze Mode**. Or,

   From the **Control** Toolbar, click  .

2. Open the View menu and select Toolbars u **Analysis**. Or,

   Click  from the **Control Toolbar**.

The **Analysis Toolbar** displays.

3. From the **Analysis** Toolbar, click . The LBP calculates the best-fit ellipse and displays it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are displayed below the Analysis Toolbar (see below).

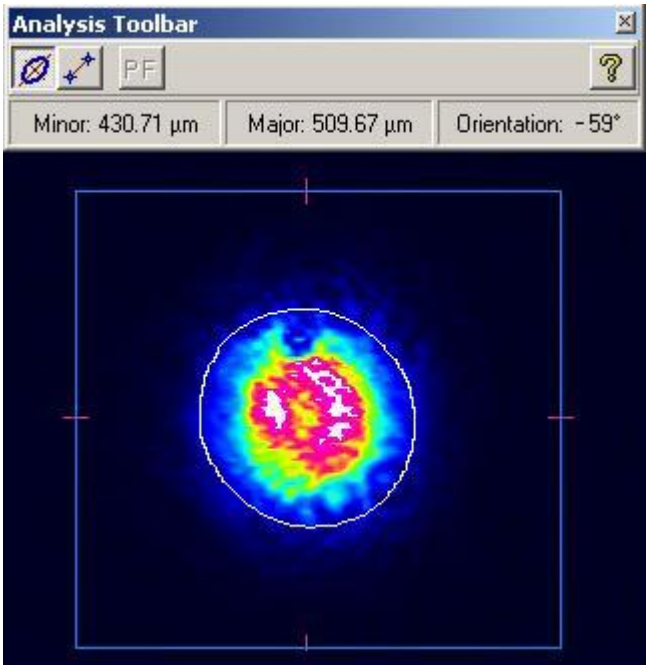


Figure 47 Best fit Ellipse

9.3 Measuring Distances

The LBP can accurately measure distances between any two points on the beam image. You select the end points and the LBP calculates and displays the results.

To measure the distance between two points on the beam image:

1. Open the Options menu and select **Freeze Mode**. Or,

   From the **Control** Toolbar, click .

2. Open the View menu and select Toolbars u **Analysis**. Or,

   From the **Control** Toolbar, click .

   The **Analysis Toolbar** displays.

3. From the **Analysis Toolbar**, click .

4. Select the first point by placing the cursor on the beam image and click the left mouse button.

5. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar.

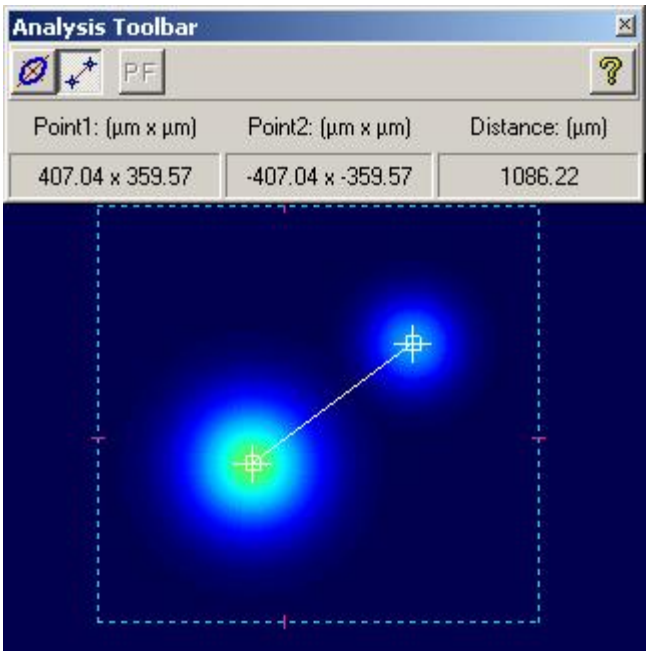


Figure 48 Measuring Distances Between two Points

10.0 Saving Data Log files

This chapter describes how to create a data log.

All the data collected by the LBP can be saved in a file with a .LOG extension. The data log files are stored in ASCII format so they can be easily printed, viewed, and analyzed by other programs. Refer to an example of the contents of a data log file (below).

The data log file contains general information including system parameters at the time of the log operation, such as the amount of averaging used, shutter level, Null (Offset) indication, zooming parameter and the size of the picture frame.

Additionally, at the lowest selected clip level beam width measurements for the horizontal and vertical profiles, centroid indication, as well as the power level value are displayed.

The end of the data log file contains a statistics summary of all the measured parameters, including the minimum measured value, maximum measured value, average measured value, as well as the standard deviation for each parameter.

10.1 Setting Up the Data Log Function

This setup screen allows the user to customize the Log operation to suit a particular need: the duration of an experiment, the rate of data saving into file, and the Log filename can be input by this setup screen. Also, data can be saved either to a Log file or to Excel file for further analysis at a later stage**.**

To setup the data log function:

1. Open the File menu and select **Log Setup**. Or,

   From the **Control Toolbar**, click  . The **Log Setup** window displays

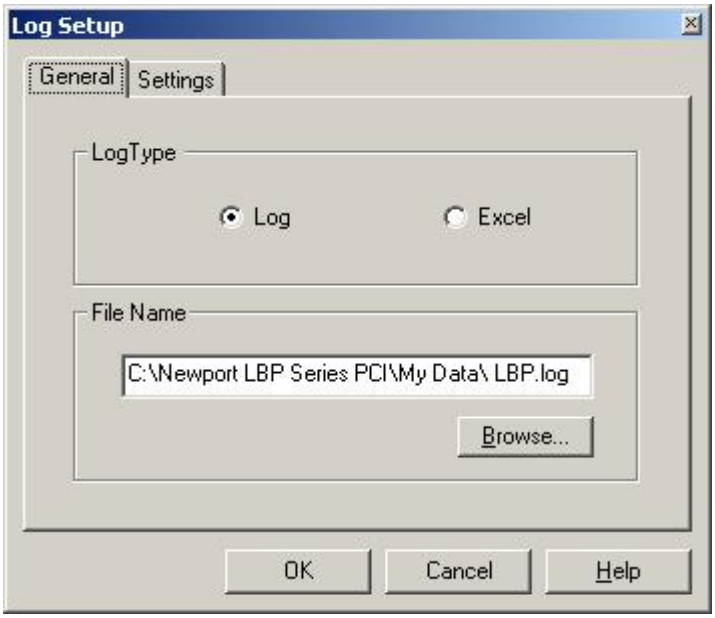


Figure 49 Log Setup

1. **Logtype:** LOG file or Excel file

2. **File Name:** Providing the system with a filename where Log data will be saved. Activate Button Browse... in order to provide the system with a filename via the standard Windows File Input interface box.

Note: When LOG file type was selected, all data collected will be saved in a file name ***.LOG**, which is a text file and can be imported into other programs. When Excel file type was selected, all data collected will be saved in a file name ***.XLS**.

3.Click **OK**.

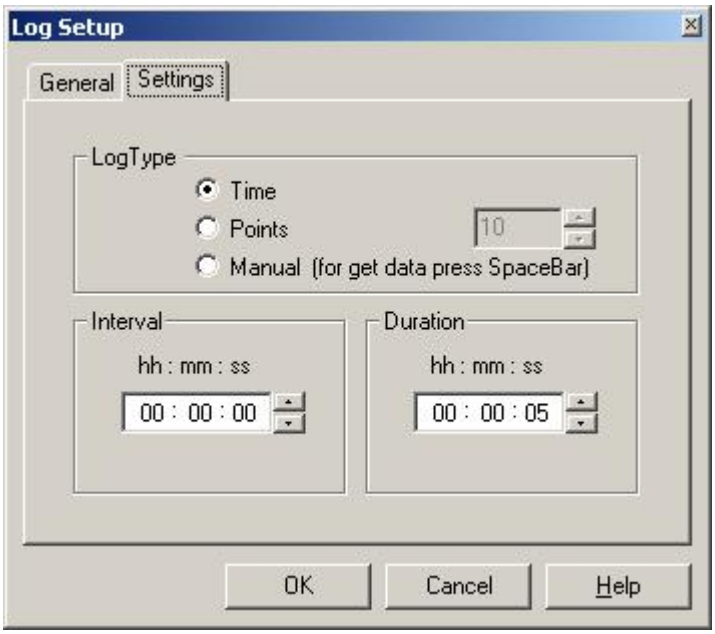


Figure 50 Log Setup – Settings Tab

Interval Configures the time interval between consecutive measurements.

To configure the time interval between consecutive measurements, enter the time. The number of hours, minutes and seconds must each be entered separately.

Duration Defines the duration of the data log function. The data log function ends automatically at the end of the duration; however, you can stop the data log function prematurely (refer to **Stop Data Logging**).

To configure the duration of the data log function, enter the amount of time. The number of hours, minutes and seconds must each be entered separately.

Log Type Provide the system with a method to control the data logging operation:

Time: Save measurements for a pre-defined duration, the interval between the saved measurements is also defined prior to saving.

Points: Save a certain amount of measurements taken at the system's data capturing rate, the exact figure is entered at the points field to the right of this option.

Manual: Save a certain measurement to the file by pressing the SpaceBar. This method is called "Event oriented", meaning once the user observes a certain measurement on the screen he can control the system to save this exact measurement data to the file, rather than other methods of stream data saving.

10.2 Start Data Logging

The LBP collects the laser beam's data in the configured data log. While the data log function is in progress, a message displays on the top left side of the screen, which reads: **Log in Progress.**

To start the data log function:

1. Open the File menu and select **Start Log**. Or,

   From the **Control Toolbar**, click  .

10.3 Stop Data Logging

The data log function automatically terminates after the user-preset time is reached. However, you can stop the function at any time.

To stop the data log function:

1. Open the File menu and select **Stop Log**. Or,

   From the **Control Toolbar**, click  .

10.4 Viewing Data Log Files

To view the data log file:

1. Open the File menu and select **View File**.
2. Select the data log file you want to view.
3. Click **Open**. The **Data Log** displays.

*** Newport LBP Series PCI Measurement system, Version 1.05 ***

UserData:

Date: 11 Dec 2003
Time: 13:27:38

Serial number: 0013

Size:	640x480
Average:	5
Zoom:	Off
Null:	Off
Gain:	10 dB
Shutter:	1/4000 sec
Level:	13.5%

Time (sec)	Centroid_H (µm)	Centroid_V (µm)	Beam Peak_H (µm)	Beam Peak_V (µm)	Width_H (µm)	Width_V (µm)	Power (mw)
0	5636.697	5116.958	5666.368	5087.760	1028.711	1051.327	0.610
1	5636.798	5117.217	5646.416	5087.760	1029.077	1052.208	0.605
2	5636.711	5117.316	5646.416	5087.760	1026.432	1051.198	0.598
3	5636.753	5117.277	5646.416	5087.760	1029.360	1051.124	0.615
4	5636.633	5117.107	5646.416	5087.760	1031.083	1051.243	0.610
5	5636.536	5117.277	5646.416	5087.760	1029.482	1052.578	0.615
**********	Statistics	**********					
Min	5636.536	5116.958	5646.416	5087.760	1026.432	1051.124	0.598
Max	5636.798	5117.316	5666.368	5087.760	1031.083	1052.578	0.615
Aver	5636.688	5117.192	5649.741	5087.760	1029.024	1051.613	0.609
STD	2.092	1.503	8.216	0.959	1.519	0.474	0.007

Figure 51 Data Log File example

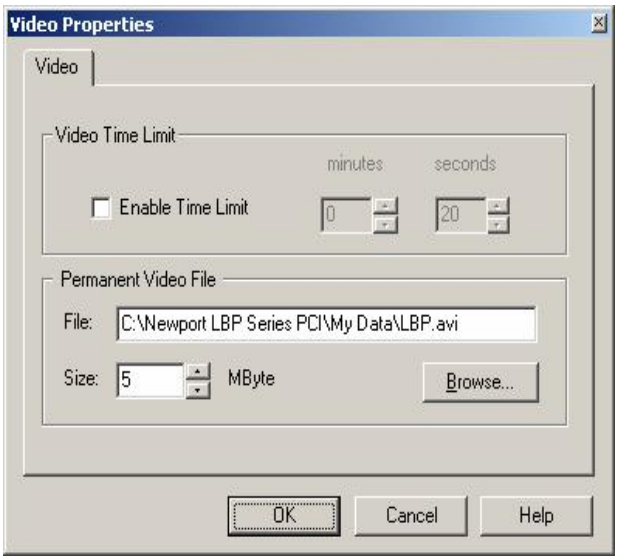
11.0 Creating / Viewing a Video

This chapter describes how to create and view a video file. The recording program enables recording and saving a continuous set of images from a single LBP camera source. The video is saved in a file with the extension .AVI.

11.1 Initializing the Video Parameters

To initialize the video parameters:

1. Open the Settings menu and select **Video Properties…**. The Video Properties window displays.



2. Enter your information according to the descriptions below.
3. Click **OK**.

Figure 52 Video Properties

Video Time Limit

Sets a time limit for the video recording.

To set the video time limit*:*

1. Select **Enable Time Limit.**
2. Enter the time limit in minutes and seconds.

Permanent Video File

This setting allows you to specify the filename and path, where the recorded video is saved. For best results, if you have multiple hard drives, this file should be located on the fastest hard disk drive or the disk drive with the most available free space.

You can also use this setting to limit the video to a selected amount of memory.

To specify a location for the video file, enter the file name and path.

To limit the video to a selected amount of memory:

1. Deselect **Enable Time Limit** check box in the **Video Time Limit** field.
2. Enter memory size (in Mbytes) in the **Size** field.

11.2 Record a Video file

When you record a video, the video is saved in the file you specified in the Video Properties window. If you don't want to overwrite this file, you must change the file name before recording a new video.

During video recording, a message at the top of the screen indicates the recording operation. When the LBP is recording a video, a message displays on the top left side of the screen, which reads: 

, and during recording the **Status Bar** presents the following pattern: 

You can change the setup parameters while recording your video (refer to **Initializing the Video Parameters**).

To record a video:

1. Open the Options menu and select **Record Video**. A checkmark is placed beside this option. Or,

   Click  from the **Control Toolbar**.

11.3 Stop the Video Recording

The video recording automatically terminates after the user-preset time is reached. However, you can stop recording at any time. When recording terminates, it is automatically saved in the file you specified during video setup.

To stop the video recording:

1. Open the Options menu and select **Record Video**. The checkmark is removed from this option. Or,

   Click  from the **Control Toolbar**.

When video recording is terminated the following message is displayed:

Figure 53 Stop video recording

11.4 Play a Video File

During a video playback routine, the LBP displays a digital presentation of the time elapsed since the video began, as well as the number of the frame being displayed.

To play a video, open the video file you want to see and use the following buttons on the Playback Toolbar to play your video:

	Play	Plays the recorded video file.
	Stop	Stops the playback of the video file once it is started.
	Rewind	Rewinds the current video one frame backwards.
	Forward	Fast-forwards the current video one frame.
	Open	Opens a video file.
	Close	Closes an open video file.

There is a slide bar in the middle of the Playback Toolbar, which moves in accordance with the video's progress. It is also possible to use this slide bar to rewind the video to its starting point, or to bring it to the end of the video.

To play a video file:

1. Open the View menu and select Toolbars u **Playback**. Or,

   Click  from the **Control Toolbar**.

   The **Playback Toolbar** displays.
2. Click  on the **Playback Toolbar**. The **Open Video File** dialog displays.
3. From the Open Video File dialog, select the video file you want to view.
4. Click **Open**. The video file displays.
5. Use the **Playback Toolbar** buttons as defined above to play the video.
6. Click  to close the video file.

12.0 Saving / Viewing Still Images

This chapter describes how to capture and view high quality digital images with your LBP. A still image is captured by digitizing a single video frame. The still images can be saved as bitmaps.

The captured image is displayed as an icon on the Status Bar with a number assigned to it. If you are using a pulsed laser, you can set the number of bitmap files that the system captures when performing a still image operation. The LBP can capture up to 12 still images during one session.

12.1 Capturing a Still Image

To capture a still image:

1. Open the Options menu and select **Still Images**. Or,

   Click  on the **Control Toolbar**.

   The image is captured and an icon is placed on the Status Bar.

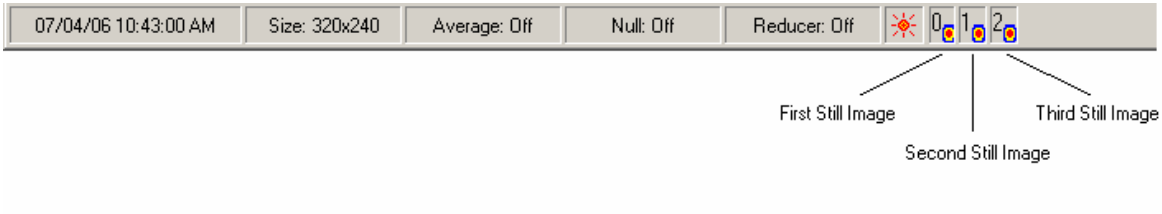


Figure 54 Status Bar with Still Image Icons

12.2 Viewing a Still Image

To view a single still image, click the still image icon on the Status Bar.

To close the magnified still image, click  in the upper right corner of the image window.

12.3 Saving / Closing Still Images

When you close a still image you must either save it or discard it. If you close a still image matrix and choose to save it, each of the images in the matrix are saved as separate bitmap files. The bitmap filenames are created by the LBP and consist of the image number, day, hour, minutes and seconds (n_ddhhmmss.bmp).

To close an opened still image or still image matrix:

1. Click  in the upper right corner of the image window. The **Still Image** window displays.
2. If you want to save the still image, click **Yes** in the Still Image window.

To close all captured images at once, open the Options menu and select **Close All Images**.

13.0 Creating / Viewing Snapshot Files

Snapshot files enable you to create and view a pre-saved snapshot image for analysis and in-depth study of a beam measurement frame stored in the system's memory.

When you view a saved snapshot file you can analyze the measured results by activating system tools, such as:

- Viewing measurement data – refer to page 64.
- Change profiles clip levels – refer to page 51.
- Explore 2D contour or 3D isometric plots – refer to page 63.
- Perform Beam Analysis – refer to page 64.

When the LBP displays the snapshot file, a message displays on the top left side of the screen, which reads: **Snapshot in progress**. The LBP does not display real-time measurements and the screen is frozen.

13.1 Creating a Snapshot File

The snapshot image is captured as soon as you select the Save Snapshot option. You then save the snapshot image as an .SNP file. The snapshot file is saved in binary format and can only be processed by this application.

To create a snapshot file:

1. Open the Options menu and select **Save Snapshot**. The Save Snapshot File window displays.
2. Enter a filename for the snapshot file.
3. Click **OK**.

13.2 Viewing a Snapshot File

To view a snapshot file:

1. Open the View menu and select **Snapshot**. The Load Snapshot File window displays.
2. Select a snapshot file.
3. Click **Open**. The snapshot file displays.

13.3 Closing a Snapshot File

To close a Snapshot file, open the View menu and select **Snapshot**. The LBP restores real-time measurement displays, or click in the upper right corner of the image window.

14.0 RS232 Communication

The LBP enables you to operate an RS-232 communication link for serial data transmission.

Any displayed data or pre-saved log file can be transmitted via the RS-232 communication link. Another computer can receive the data using a program that can communicate over a COM Port like Windows Hyper Terminal program.

While the link function is in progress, a Link in progress message displays on the top right corner of the Menu Bar.

Transmitting serial data requires the following steps:

- Setting up the parameters needed for the link transmission.
- Making a null modem cable for connecting the two computers.
- Starting the link transmission.
- Terminating the link transmission.

14.1 Setting Up for RS232

The LBP allows you to configure a particular set of parameters needed for the RS-232 transmission.

To configure the RS-232 link:

1. Open the File menu and select **Link Setup**. The Link Setup window displays.
2. Click the **General** tab.

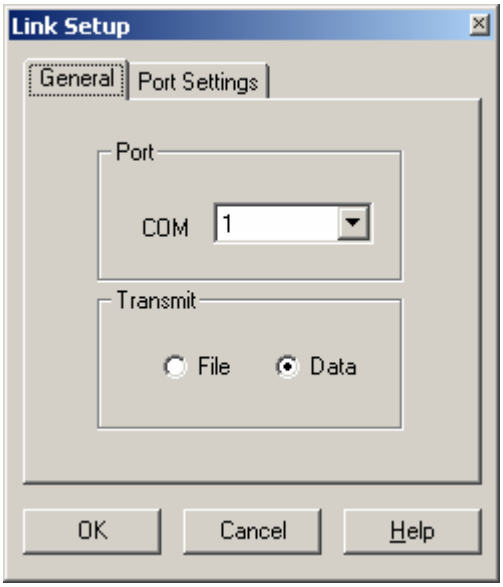


Figure 55 Link Setup - General Tab Selected

3. Complete the information as described below.

Port Sets the computer communication port through which the data is transmitted over the RS-232 link. The possible values for Port are 1 through 4, for COM1 through COM4 respectively.

Transmit Select one of the radio buttons:

- **File** - transmits a pre-saved text file.
- **Data** - transmits real-time measurements. The data is sent in the sequence and format of the saved data in the text (ASCII) file.

4. Click the **Port Settings** tab.

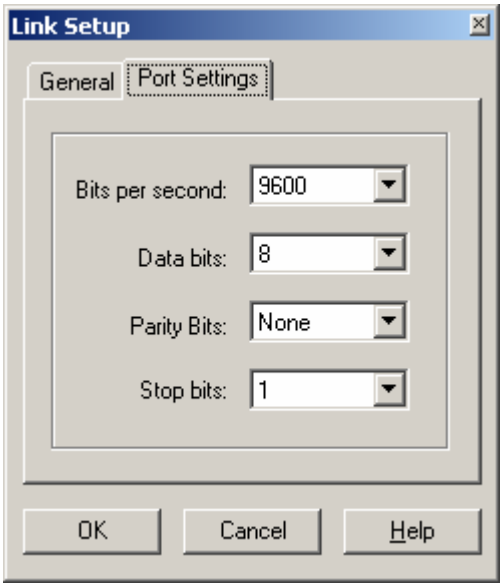


Figure 56 Link Setup - Port Settings Tab Selected

5. Complete the information as described below. These settings must match the settings on the receiving computer.

Frequency Sets the transmission rate for the RS-232 link. The possible values for Frequency are: 110, 300, 600, 1200, 2400, 9600, 14400, 19200, 38400, 57600, 115200.

Data Bit Determines the number of bits used for the RS-232 transmission. The possible values are: 4, 5, 6, 7, and 8.

Parity Bit Determines whether or not a parity bit is transmitted. The possible values are: None, Odd, Even, Space, Mark.

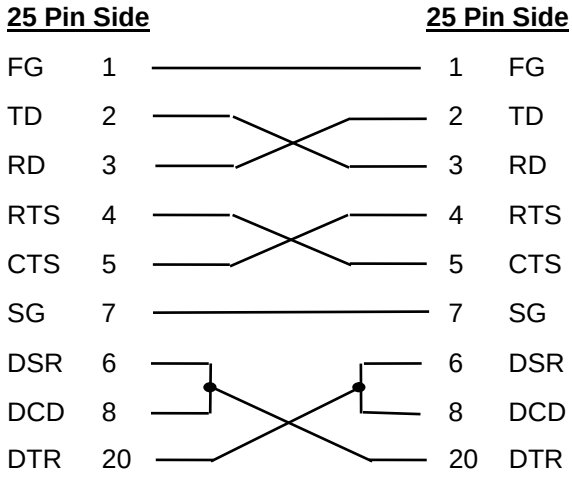
Stop Bit Determines the number of stop bits transmitted. The possible values are: 1 or 2.

6. Click **OK**.

14.2 Making a Null Modem Cable

A null modem cable can be made from a standard RS-232 cable by connecting the pins on one end of the cable to the pins on the other end as shown below.

Null modem cable with 25 pins on both sides:



Null modem cable with 9 pins on both sides:

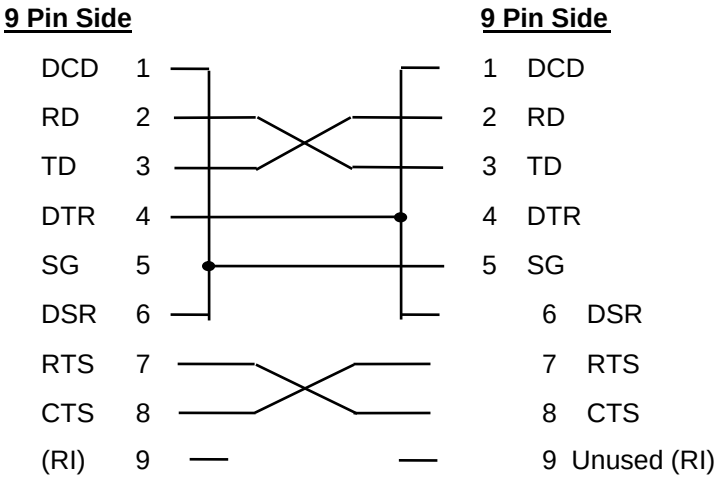


Figure 57 Null Modem cable

14.3 Starting an RS-232 Link Transmission

The file (or measured data) is transmitted in the background while the system continues to capture data. When the LBP is transmitting data, a message displays on the top left side of the screen, which reads: **Link in progress**.

If you transmit a file, the contents of the file are sent.

If you transmit real time data, the following information is sent:

- Time of measurement
- Beam Centroid (H)
- Beam Centroid (V)
- Beam Peak (H)
- Beam Peak (V)
- Width (H)
- Width (V)
- Power

To transmit files over an RS-232 link:

1. Connect the LBP computer to another computer using a null modem cable.
2. Enable the receiving program to receive the file/data.
3. Open the File menu and select **Start Link**.
4. If you are transmitting data the LBP immediately starts sending measured data via the RS-232 link. A “link in progress” message displays on the Menu Bar. Proceed to **Terminating an RS232 link.**
5. If you are transmitting a file, the **Link File** window displays. Select the file you want to send. A 

message displays on the Menu Bar.
6. Click **OK**.

14.4 Terminating an RS-232 Link Transmission

When transmitting a file, the RS-232 link transmission is automatically terminated upon completion of the transmission. However, if you are transmitting data, or you want to terminate your file transmission, you can manually terminate a transmission in progress.

To stop a transmission in progress, open the File menu and select **Stop Link**.

15.0 Troubleshooting

If, after reading this chapter and reviewing relevant portions of the user manual or on-line help, you still have a question, refer to **Customer Support** on page 87.

15.1 Common Operating Problems

The following are some common problems and possible solutions:

Problem	Possible Solution
Display Problems:	
• No picture appears on the screen	• Make sure that the LBP camera is connected correctly (refer to **Connecting the CCD camera to the PCI card**). • If you are using a camera other than the one provided by the LBP System, make sure it is turned on. • Check the Settings parameters (refer to **Setting Up the LBP**). If this does not correct the problem: • Refer to **Windows 2000/XP/Vista Installation**.
• Scrambled Image	Verify the NTSC/PAL setting is correct (refer to Standard option in **Hardware Setup**). Check that hardware is connected properly (CCD camera), refer to **Connecting the CCD Camera to the PCI card**). If this does not correct the problem: • Refer to **Windows 2000/XP/Vista Installation**.
Other Windows applications run slowly, or appear to be interrupted	Because the LBP System must constantly collect and analyze data, it might not work well with all Windows applications. If you want to use another application while the LBP System is running, select **About** from the Help menu. This will cause the LBP to pause the data collection. Now run your other application.
System Locks-up During Software Startup	• Refer to **Windows 2000/XP/Vista Installation**.
The following error message displays: ”The Device is Not Ready or Busy, OK”	After receiving this error message, system operation is halted. Reboot you computer and restart the LBP program. This message is due to an internal problem, such as the drivers are not able to find the video card. Before rebooting your computer, verify that: • The card is firmly seated in the Chassis. • The drivers were correctly installed. • The slot is working correctly by installing the board in another slot. BE SURE TO TURN OFF THE COMPUTER BEFORE ADJUSTING THE HARDWARE.

Problem	Possible Solution
The following error message displays: ”Hardware Error #1: Can not find the capture card. Would you like to run Demo version?”	• Please verify that the PCI card is firmly inserted and secured in its slot. • Remove PCI card from its original slot and try in another slot, or install in another computer.
The following error message displays: ”Hardware Error #2: the capture card is corrupted and system can not be loaded, please contact your provider.”	• Remove PCI card from its original slot and try in another slot, or install in another computer. If this does not help – contact your provider.
The following error message displays: “Hardware error #1 : Cannot find the USB Capture Box”	Possible problems include: • Check proper connection of USB video device • Unsuccessful installation of the video device – check installation via Windows Device Manager. See more details at the **Software Installation – USB 2.0 Attachment**. • Problem with video card hardware – contact your provider
The following error message displays: "Failed to find LBP Series USB2 camera in MXC input. Please connect camera to USB 2.0 Video Device and Restart program."	• Connect camera to USB 2.0 Video Device and Restart program
The following error message displays: “Please check 12V connector”	• Check that the 12V connector is plugged into USB 2.0 Attachment, or power supply is plugged into electricity outlet. This is applicable only for revisions "A" through "C".
The following error message displays: “Not enough power from USB port.”	• Try operation at another USB2.0 port. This is applicable only for revision "D".
The following error message displays: “Video Device Error”	• Contact factory for Service

Problem	Possible Solution
Display does not update fast enough	The display update rate of a particular computer is influenced by a variety of factors: • CPU Speed • Computer RAM • Video Card • Video RAM • Screen resolution • Screen color depth • Other applications open at the same time Refer to **Hardware Requirements** to see if your computer meets minimum requirements. Upgrade your computer hardware or close other opened applications.
The power value in the Measurement Data window is not correct	Verify that: • The Power Calibration is set (refer to **Configuring Hardware** topic). • The Null Calibration is performed (refer to **Setting the Ambient Light Suppression (CW lasers)**. • The LBP camera is not saturated (refer to **Using Filters**).
Image is seen, but appears faint (weak intensity)	• Try setting a smaller shutter speed or Gain value in order to improve the image presentation (refer to **Configuring the Hardware**, Shutter option or Gain. • Use the Zoom option to magnify the image display (refer to **Configuring the Software**, option Zoom).
Screen image is frozen, no real-time measurements	• Verify that the Freeze option is not activated, by checking the menu bar for a “freeze” message (refer to **Freezing Screen Graphics**). • Verify that the Snapshot option is not activated, by checking the menu bar for a “snapshot” message (refer to **Creating / Viewing Snapshot files**.
The image in the view area does not fully display	If the Zoom option is greater than 100%: • Use the scroll bars to reach the main image presentation display. • Reduce the Zoom value to 100%.
The Control Toolbar is not complete	You must use a 1024 x 768 resolution screen in order to fully view all the graphics. If you are using a 720 x 576 resolution screen, the complete Control Toolbar is not seen. You can still operate the system using the menu commands for activating the hidden **Control Toolbar** icons.

16.0 A P P E N D I X

1. NG4 filter transmittance & curve
2. NG9 filter transmittance & curve
3. NG10 filter transmittance & curve
4. ActiveX Software

NG 4

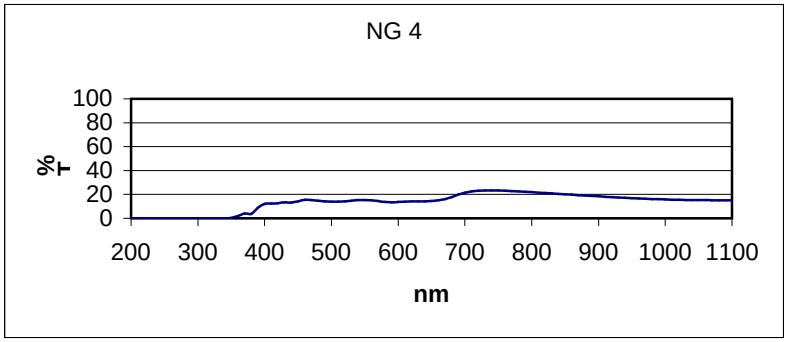
Diameter 12,7 mm

Thickness 1,6 mm

Wavelength-nm	Transmission-%
350	0.353
360	1.767
370	3.89
380	3.866
390	8.864
400	12.014
410	12.274
420	12.659
430	13.459
440	13.25
450	14.276
460	15.416
470	15.369
480	14.809
490	14.304
500	14.039
510	13.985
520	14.23
530	14.68
540	15.153
550	15.267
560	14.955
570	14.377
580	13.772
590	13.439

Wavelength-nm	Transmission-%
600	13.574
610	13.898
620	14.223
630	14.342
640	14.282
650	14.388
660	14.885
670	16.003
680	17.803
690	19.871
700	21.517
710	22.503
720	23.025
730	23.256
740	23.304
750	23.211
760	23.032
770	22.776
780	22.51
790	22.197
800	21.865
810	21.507
820	21.171
830	20.809
840	20.45
850	20.092
860	19.754
870	19.401
880	19.088
890	18.738

Wavelength-nm	Transmission-%
900	18.385
910	18.078
920	17.766
930	17.459
940	17.179
950	16.905
960	16.637
970	16.404
980	16.19
990	15.984
1000	15.807
1010	15.644
1020	15.493
1030	15.364
1040	15.271
1050	15.191
1060	15.169
1070	15.121
1080	15.072
1090	15.129
1100	15.125



NG 9

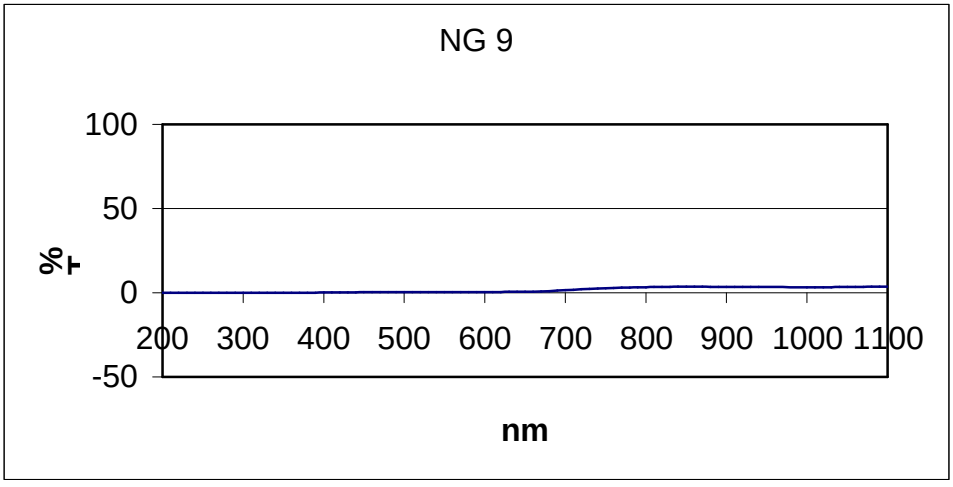
Thickness 1,6 mm +/- 0,1 mm

Diameter 12.7mm

Wavelength-nm	Transmission-%
350	0.002
360	0.001
370	0
380	0.008
390	0.049
400	0.117
410	0.159
420	0.196
430	0.241
440	0.244
450	0.294
460	0.366
470	0.378
480	0.362
490	0.342
500	0.335
510	0.327
520	0.332
530	0.345
540	0.362
550	0.365
560	0.361
570	0.35
580	0.34
590	0.344

Wavelength-nm	Transmission-%
600	0.367
610	0.402
620	0.446
630	0.485
640	0.523
650	0.575
660	0.654
670	0.781
680	0.978
690	1.236
700	1.517
710	1.787
720	2.033
730	2.252
740	2.454
750	2.633
760	2.802
770	2.962
780	3.086
790	3.204
800	3.31
810	3.395
820	3.456
830	3.502
840	3.53
850	3.542
860	3.548
870	3.53
880	3.515
890	3.489

Wavelength-nm	Transmission-%
900	3.453
910	3.421
920	3.396
930	3.364
940	3.333
1000	3.268
1010	3.278
1020	3.298
1030	3.317
1040	3.347
1050	3.374
1060	3.423
1070	3.486
1080	3.522
1090	3.602
1100	3.675



Type : **NG10**

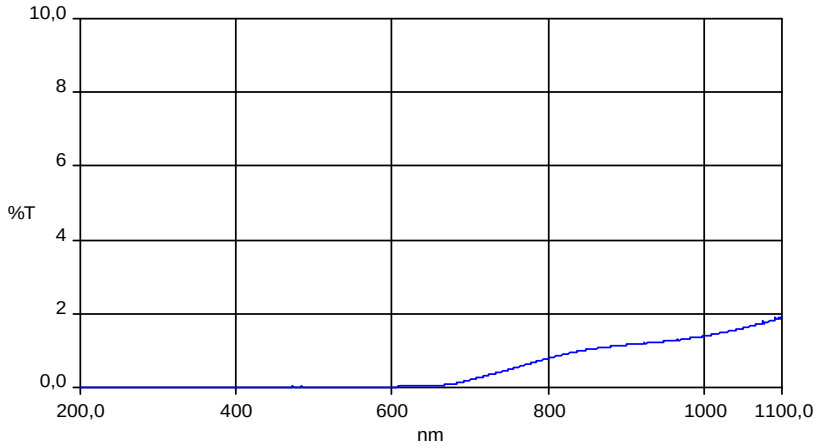
Thickness **1,6 mm**

Diameter **12,7 mm**

Wavelength-nm	Transmission-%
350	0.000
360	0.000
370	0.000
380	0.008
390	0.000
400	0.000
410	0.003
420	0.000
430	0.001
440	0.007
450	0.011
460	0.017
470	0.020
480	0.016
490	0.016
500	0.022
510	0.016
520	0.015
530	0.017
540	0.021
550	0.020
560	0.019
570	0.018
580	0.019
590	0.018
600	0.021
610	0.024

Wavelength-nm	Transmission-%
620	0.030
630	0.031
640	0.037
650	0.043
660	0.054
670	0.073
680	0.107
690	0.152
700	0.206
710	0.259
720	0.313
730	0.369
740	0.429
750	0.485
760	0.545
770	0.608
780	0.671
790	0.726
800	0.788
810	0.845
820	0.904
830	0.942
840	0.984
850	1.023
860	1.062
870	1.084
880	1.112
890	1.135
900	1.153
910	1.169
920	1.189

Wavelength-nm	Transmission-%
930	1.209
940	1.225
950	1.249
960	1.273
970	1.297
980	1.333
990	1.360
1000	1.393
1010	1.431
1020	1.471
1030	1.510
1040	1.558
1050	1.603
1060	1.653
1070	1.717
1080	1.776
1090	1.801
1100	1.904



ActiveX Software

Introduction

As mentioned in previous chapters, the Newport LBP Series is a full capture and analysis application with sophisticated capabilities. However, many customers have special analysis demands and tools, yet are lacking data collection capabilities. In order to meet this demand, the “Newport LBP Series.exe” file can act as an ActiveX server. This allows system integrators to integrate the LBP ’s data capture capabilities with legacy analysis packages.

This has been tested in LabVIEW 7.0 (National Instruments) as well as Visual Basic 6.0 (Microsoft). In practice, these controls can be used in any environment that allows interaction with ActiveX servers (although it hasn’t been tested with tools other than those mentioned).

Registration

The ActiveX controls will be registered the first time that the LBP software application is run.

Examples

Examples of a LabVIEW and a Visual Basic application are provided with the installation CD disk. All examples assume a rudimentary knowledge of the respective development platforms.

Active X Details

Types

1) **ccdSize**
   a. Defines size of capture screen (used with the SizeCapture property)
   b. Values
      i. ccdSmall = 0 (176 x 144 pixels)
      ii. ccdMedium = 1 (352 x 288 pixels)
      iii. ccdLarge = 2 (720 x 576 pixels)
2) **ccdUpdated**
   a. Flag used to inform calling application if camera has made a new measurement (used with the DataUpdated property). Also used on startup to inform calling application that the camera has been initialized (used with the SettingsUpdated property)
   b. Values
      i. ccdNotUpdated = 0 (Settings/Data not yet updated)
      ii. ccdUpdatedSusccessful = 1 (Settings/Data have been updated)
      iii. ccdFailed = -1 (Failed to set up initial settings)

Events (in Visual Basic only)

Note: Events can only be used in Visual Basic applications. In order to use events, the EventsEnabled property (described below) must be set to TRUE.

1) DataUpdated: LBP has made a new measurement
2) ShutterChanged: Shutter setting has been updated
3) GainChanged: Gain setting used by hardware has been updated
4) ErrorMessage: LBP is reporting an operational error (as a code and as a text message).

Properties

1) **ShutterTable**
   a. Used to get the shutter table used by the camera hardware
2) **Shutter**
   a. Used to get or set the shutter time of the camera
   b. Used Shutter value from array values of the Shutter Table
3) **GainTable**
   a. Used to get the gain table used by the camera hardware
4) **Gain**
   a. Used to get or set the gain used by the camera hardware
   b. Used Gain value from array values of the Gain Table
5) **SizeCapture**
   a. Used to get or set the size of the capture screen
   b. Used with the ccdSize type described above
6) **ClipLevel**
   a. Used to get or set the Clip Levels of the profiles
7) **EnableEvents**
   a. Used to enable Visual Basic events. This is compatible with Visual Basic applications that used simple broadcast events.
   b. Default is set to FALSE (no Visual Basic events)
8) **SettingsUpdated**

a. Used on startup to inform the calling application that the CCD Profiler has finished its initialization
b. Used with the ccdUpdated type described above

9) DataUpdated

a. Used by non-Visual Basic applications.
b. Set to 0 by calling application to request new measurement from the LBP
c. Set to 1 by LBP to inform calling application that a new measurement has been made and processed

Methods

1) HideForm

a. When launched, the LBP window is displayed. This property allows the window to be hidden without affecting measurements, thereby freeing the screen for the calling application.

2) ShowForm

a. Allows LBP window to be displayed

3) GetCentroid

a. Returns horizontal and vertical centroid in a 2 elements array
b. Values are in microns

4) GetPeak

a. Returns horizontal and vertical Beam peak in a 2 elements array
b. Values are in microns

5) GetBeamWidths

a. Returns array of horizontal and vertical beamwidths at all 3 clip levels
b. First 3 elements are horizontal beamwidths at clip levels 1,2, and 3
c. Second 3 elements are vertical beamwidths at clip levels 1,2, and 3
d. Values are in microns

6) GetGaussWidths

a. Returns array of horizontal and vertical gaussian widths at all 3 clip levels
b. First 3 elements are horizontal gaussian widths at clip levels 1,2, and 3
c. Second 3 elements are vertical gaussian widths at clip levels 1,2, and 3
d. Values are in microns

7) GetGaussCorrelation

a. Returns horizontal and vertical correlation in a 2 elements array
b. Values are in percent

8) GetColorMaxAmplitude

a. Return highest pixel intensity measured
b. Value is between 0.0 and 100.0

9) GetAmplitudeVectorX

a. Returns horizontal profile as array with values from 0.0 to 100.0
b. Array length is a function of capture size

10) GetAmplitudeVectorY

a. Returns vertical profile as array with values from 0.0 to 100.0
b. Array length is a function of capture size

11) GetMatrix

a. Returns input matrix array from CCD detector with values from 0 to 255
b. Array length is a function of capture size

12) GetPower

a. Returns power measured in milliwatts
b. If LBP wasn't calibrated for power, returns 0.

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